COAL MINING

UNIVERSITY MICROFILMS
313 N 1ST ST
ANN ARBOR, MICH

May, 1955

Volume 32, No. 5

Name your equipment needs... we can fill them!

Lima 2400 . . . TORONTO COAL CO., Knoxville

Allis-Chalmers HD-21 . . . KRISTIANSON & JOHNSON COAL CO., Lanse

Lima 1201 . . . NORTH SEWICKLEY COAL CO., Beaver Falls

From Allis-Chalmers HD-21s—mightiest of all tractors—to small drill bits . . .

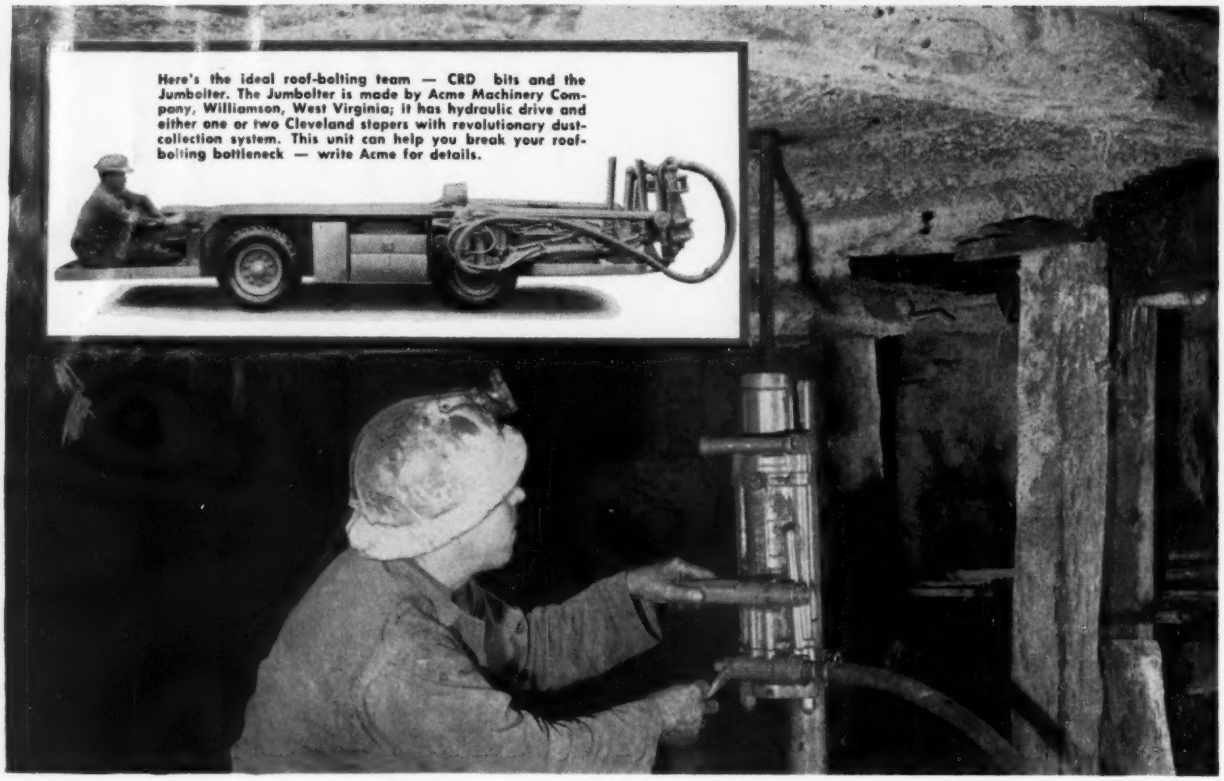
Regardless of the nature or size of your mining equipment needs, Highway is prepared to serve you promptly, efficiently, economically.

Allis-Chalmers HD-5 with front end shovel . . . LITTLE GEM CONTRUCTION CO., East Brady

Highway EQUIPMENT COMPANY

6465 Hamilton Ave.
Pittsburgh 6, Pa.

ALLIS-CHALMERS • GENERAL MOTORS DIESEL ENGINES
LIMA SHOVELS, CRANES, DRAGLINES • BAKER • THOR
POWER-PACK CONVEYORS • GAR WOOD • ERIE BINS
MICHIGAN TRACTOR SHOVELS AND EXCAVATOR-CRANES
MASTER • INTERNATIONAL VIBRO-TAMPERS • JAEGER



Here's the ideal roof-bolting team — CRD bits and the Jumbolter. The Jumbolter is made by Acme Machinery Company, Williamson, West Virginia; it has hydraulic drive and either one or two Cleveland stopers with revolutionary dust-collection system. This unit can help you break your roof-bolting bottleneck — write Acme for details.

The Price Alone of CRD one-use bits can lower your drilling costs

. . . and they are made and backed by CLEVELAND Rock Drill

How do Cleveland CRD one-use bits save you money? It's just plain economics. You see, the price of CRD bits on an average, is less than one-half that of a multi-use bit. In fact, the price of a CRD bit comes close to matching the cost of reconditioning a multi-use bit.

So the price alone of CRD one-use bits can help you cut your drilling costs. But there are other reasons to use CRD bits, too.

Faster Drilling Speed — Special offset gauge feature, which permits the use of thinner wings and a steeper reaming angle, greatly reduces binding and provides ample clearance for cuttings. Result is a free, fast-cutting, chiseling action that gives you greater drilling speed.

Less Drill-Steel Breakage — The method of attachment used with the CRD bit eliminates threads on the drill rod. Since a drill rod is only as strong as the root diameters of its threads, the tapered threadless CRD design provides longer drill-steel life — reduces drill-steel handling and reconditioning costs.

Lower Rock Drill Repair Costs — Because the CRD bit design reduces binding in the hole, there is less strain on the rotation parts of your rock drills. Rifle bars, rifle nuts, and chucks last longer. You get more drilling done at lower cost.

Since no special equipment is needed for reconditioning bits or threading rods, you owe it to yourself to try a can of CRD bits. They're ideal for roof-bolting. A short trial will give you first-hand information on the ability of these bits to cut drilling costs in your property, as they have in so many others.

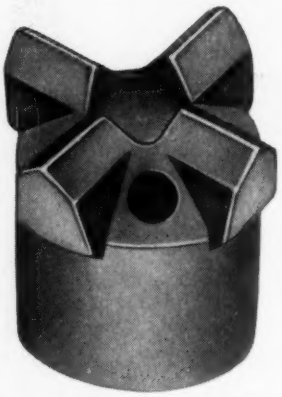
Bulletin RD-29 gives detailed information. A copy is yours for the asking — just write for it.

SPECIFICATIONS

Mines everywhere cut drilling costs with CRD DETACHABLE DRILL BITS
4-Wing Type — Center Hole — Side Hole

Series "A" Bits For series "A" drill steel connection on any steel. Best suited to 7/8" steel.	1 1/4	Aluminum	Series "B" Bits For series "B" drill steel connection on any steel. Best suited to 1", 1 1/8", and 1 1/4" steel.	1 7/16	Orange
	1 5/16	Pink		1 1/2	Green
	1 3/8	Deep Green		1 9/16	Yellow
	1 7/16	Brown		1 5/8	White
	1 1/2	Grey		1 11/16	Black
	1 5/16	Maroon		1 3/4	Red
	1 5/8	Deep Blue		1 13/16	Blue
				1 7/8	Tan
				1 15/16	Plain
				2	Pink
				2 1/8	Maroon
				2 1/4	Aluminum

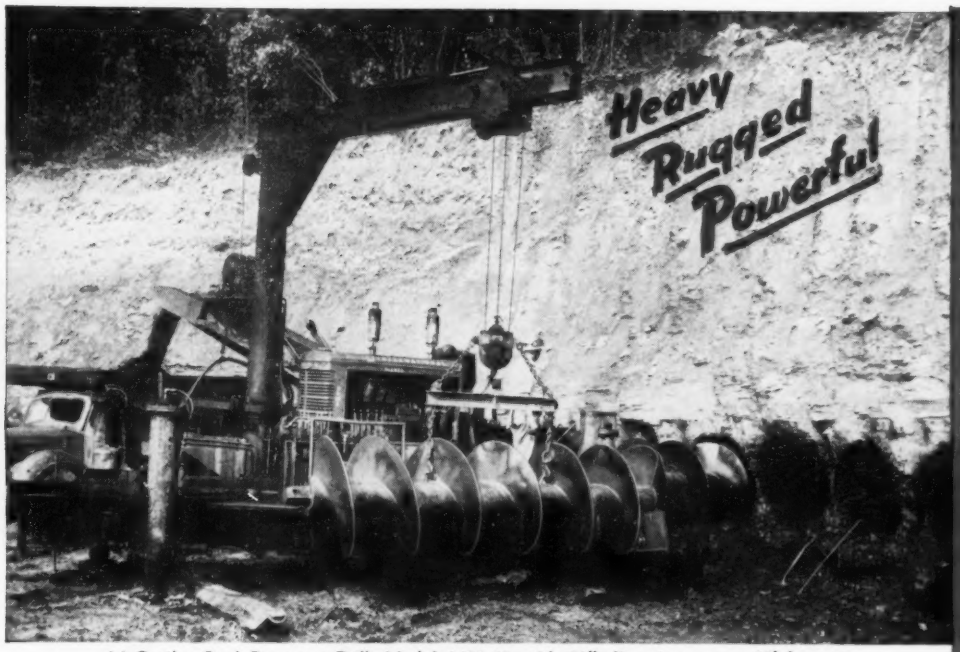
Cans are labeled showing size of steel socket, gauge of bit, and color.



CLEVELAND ROCK DRILL DIVISION
Westinghouse Air Brake Co.

12500 BEREA ROAD
CLEVELAND 11, OHIO

RD-61



McCarthy Coal Recovery Drill, Model 1436-42, with 36" diameter augers 12' long as used by Excavators, Inc., Sommerville, W. Va.

● Robert B. Cleghorn, Jr., Hodgeville, West Virginia, reports his hydraulical, self-moving 42" McCarthy Coal Recovery Drill (shown below) mines "up to 500 tons of clean, low-cost quality coal per day." Cleghorn has a three-man crew—operates in pits as narrow as 34 feet. Operator has total vision, including the highwall. Model 12 handles 24' augers from 16" to 48" in diameter.

Hydraulically operated equipment on McCarthy Drills includes: jacks for levelling auger drill, auger guide, auger hoist, moving jacks and skids, and auger feed.

McCarthy Auger Drills Lower Mining Costs

McCarthy Coal Recovery Drill, Model 1242-36, using 42" diameter augers 12' long.

THE SALEM TOOL COMPANY

SOUTH ELLSWORTH AVE. • SALEM, OHIO, U. S. A.

Published monthly by Modern Mining Publishing Company. Publication Office—Advance Printing & Litho Co., Erie, Pa. Editorial and Executive Offices, Erie, Pa. Home address: P. F. JASIK, Publisher, 4575 Country Club Drive, Pittsburgh, Pa. Price: in the United States, $2.00 year; all other countries $5.00. Single copy 50 cents. Entered as second class matter at the Post Office at Erie, Pennsylvania, under the act of March 3, 1879.

To meet the stepped-up needs of industry . . .

ALLIS-CHALMERS PRESENTS TWO

ALLIS-CHALMERS TS-360

280 HP

15-YD CAPACITY, STRUCK

20-YD CAPACITY, HEAPED

NEW BIG-YARDAGE WORK CAPACITY!

Power that pays

The TS-360's great new Allis-Chalmers engine spearheads a whole new power train that offers more rim pull at lower speeds for better loading, hauling and spreading performance; faster acceleration, easy shifting and quick getaways. Combined with new 20-yd capacity, this all adds up to fast, high-volume, high-profit work cycles.

New operating ease and safety

In addition to big-job power and gearing, the TS-360 Motor Scraper offers everything an operator needs to work easily, yet efficiently . . . new Double-Safety air brakes, new selective steering, direct electric starting, new multiple-disc cable control . . . and many others you'll want to know more about.

Strength to back it up!

The new TS-360 is built around a new, all-welded, heavy steel main frame that makes possible the service accessibility of unit construction. What's more, there's an all-new final-drive gear train, with new gears, shafts and bearings. These and many other advantages mean more work done, lower maintenance cost and longer equipment life.

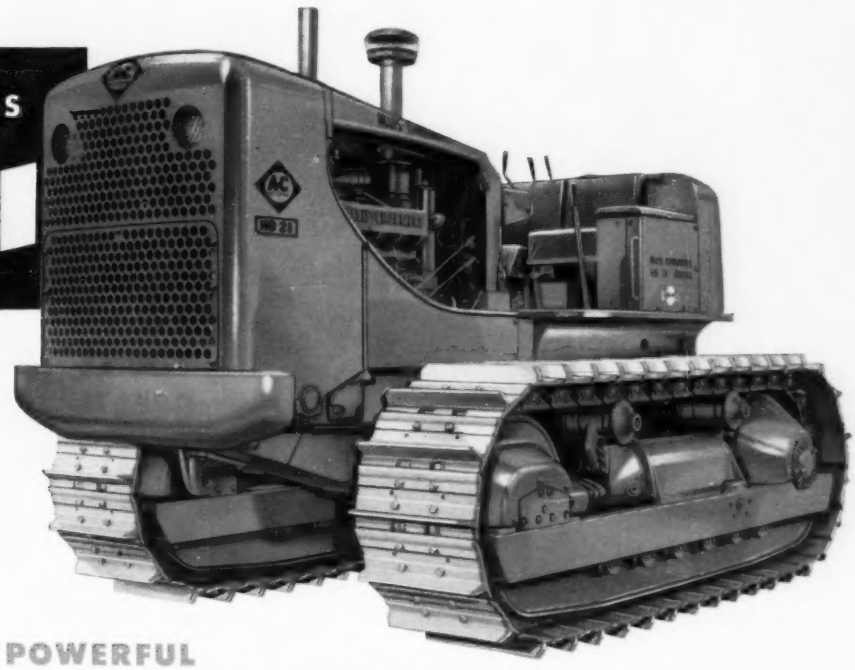
Nowhere can you match these two in the amount of work they do!

. . . for more power—better performance—longer life . . .

NEW, POWERFUL DIRT MOVERS

ALLIS-CHALMERS

HD-21



204 NET ENGINE HP

44,000 LB

BIGGEST, MOST POWERFUL CRAWLER IN PRODUCTION . . . ANYWHERE!

New standards of output

The HD-21 introduces the new Allis-Chalmers engine and a great new power transmission team. Together, they provide extra speed with any load, extra pulling power at any speed . . . wider speed ranges and more range overlap. And with its advanced design torque converter (*the result of 15 years of leadership by Allis-Chalmers*) the HD-21 puts its power to work with less shifting than ever before possible . . . to help you reach a new high in efficient, profitable production!

New standards of durability

From the new Allis-Chalmers diesel with "follow-through" combustion to new, heavier Tru-Dimension track, the HD-21 is built to take today's big loads in stride, and come back for more. Here are just a few more of the long-life features you can't get from anyone but Allis-Chalmers . . . at any price: all-steel Box-A main frame, straddle-mounted final-drive gears, 1,000-hour truck wheel lubrication, oil-enclosed track release mechanism.

New low cost per unit of work

The HD-21 offers 20 percent greater over-all performance . . . provides a new measure of tractor value. Add the *planned* approach to service offered by Allis-Chalmers dealers, and it's the ideal team for men tackling today's big jobs.

ALLIS-CHALMERS

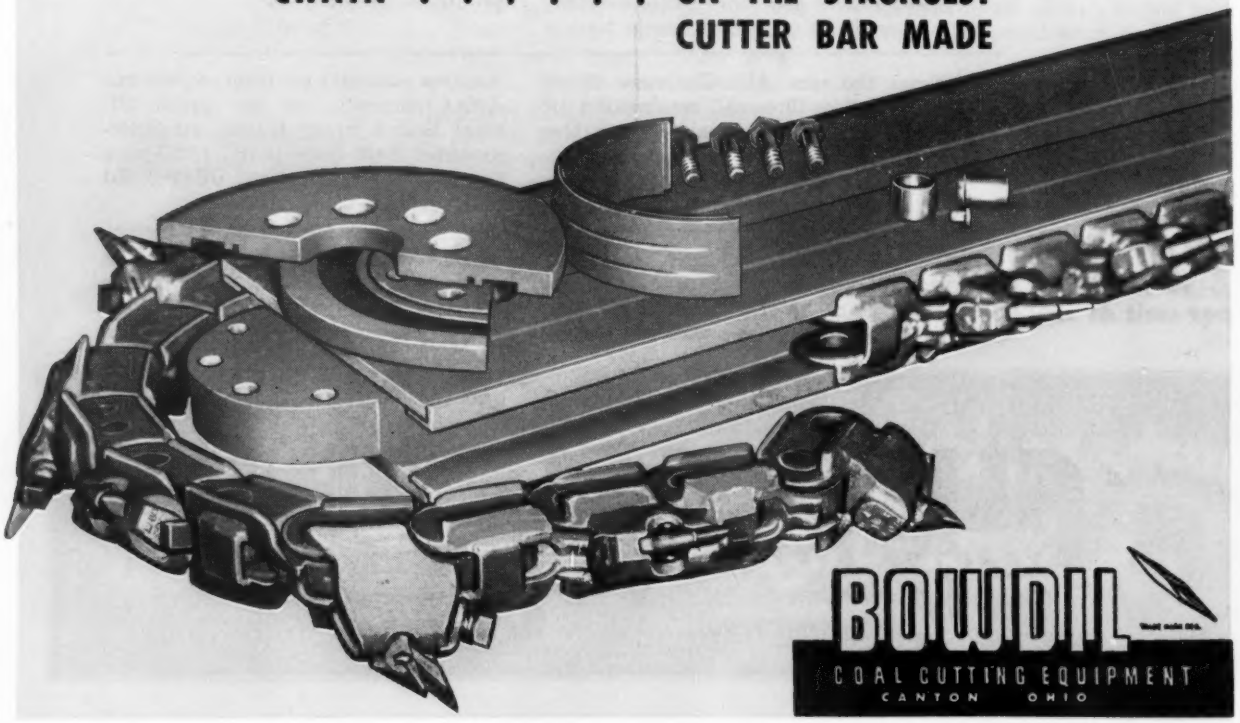
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

THIS IS THE POINT WHERE PROFITS BEGIN $

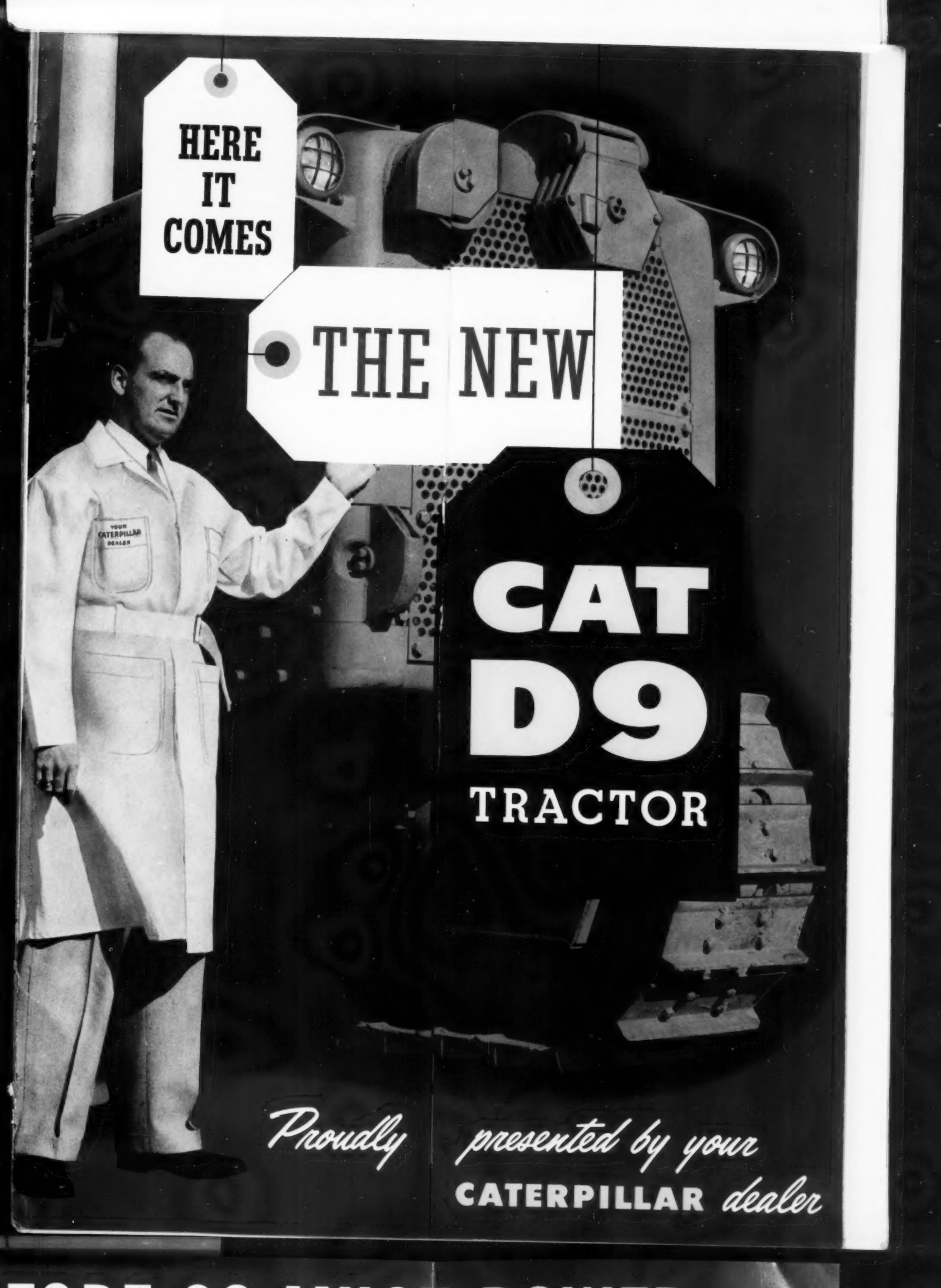
AT THE SHOW . . .
BOOTH 1006

YOU'LL FIND YOUR GREATEST ECONOMY IN BOWDIL BITS

HELD BY THE LONGEST LASTING CHAIN . . . . . ON THE STRONGEST CUTTER BAR MADE



BOWDIL
COAL CUTTING EQUIPMENT
CANTON OHIO


HERE IT COMES
THE NEW
CAT D9 TRACTOR
YOUR CATERPILLAR DEALER
Proudly presented by your CATERPILLAR dealer

A GREAT, NEW TRACTOR

Built for Your Jobs

Meet the new Caterpillar D9 Tractor! You've heard about it. The equipment world has waited for it. Now—here it is . . . in all of its bigness . . . in all of its newness . . . ready to go to work for you after years of research and field testing. You'll want to check the new Cat D9 Tractor from top to bottom, but here are a few of the highlights that will set the construction world to talking . . .

- **BIG HORSEPOWER**
  . . . 230 at the drawbar, 286 under the hood.

- **BIG WORK CAPACITY**
  . . . 60,860 pounds of drawbar pull.

- **BIG SAVINGS**
  . . . Cat-built diesel Engine designed specifically for the D9, works at 1200 RPM, produces full power on No. 2 burner fuel.

- **BIG STARTING CONVENIENCE**
  . . . independent, 2-cylinder starting engine electrically started from seat.

- **BIG TRACTION**
  . . . 6,228 square inches of ground contact; 24-inch shoes; hydraulic track adjustment.

- **BIG SELECTION**
  . . . match your job with the D9, equipped with the Cat oil clutch and six-speed transmission; or with the torque converter drive with a variety of speeds in each of three ranges.

- **BIG SIZE**
  . . . 17′ 10¾″ long; 8′ 9″ high; 9′ 11¼″ wide.

- **BIG STRENGTH**
  . . . special high strength steel used in all structural members.

- **FIRST WITH THE TURBOCHARGER**

For details on these and other features of the great D9 see your Caterpillar Dealer.

CATERPILLAR®

GET THE FACTS ON THE NEW D9

NEVER BEF

THE NE

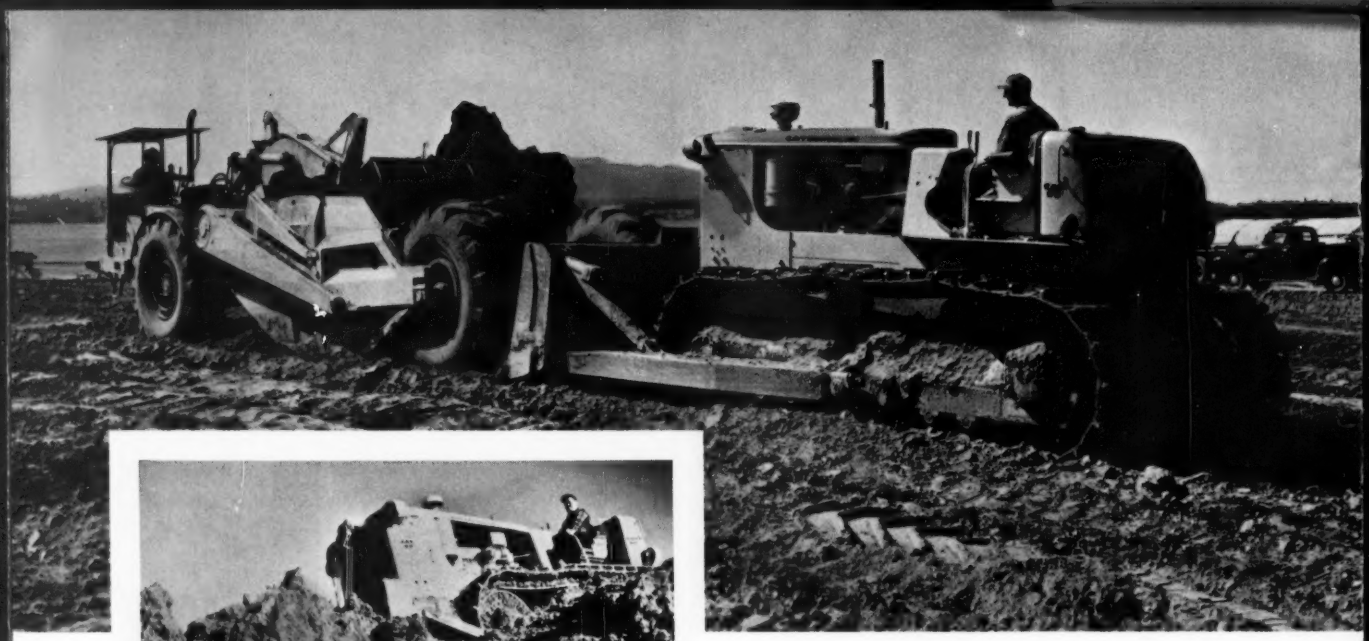
CAT®

TRACT

FORE SO MUCH POWER·
TRACTION·STAMINA!

EW
D9
TOR

- *Featuring 230 Drawbar HP . . . 60,860 lbs. Drawbar Pull.*
- *Featuring a Newly Designed Engine, Expressly Built for the New D9.*
- *Another All-Caterpillar Built Diesel Tractor . . . Sold and Serviced by Your Caterpillar Dealer.*



NEW POWER

...WITH MATCHED EARTHMOVERS!

Now, you can tackle those "king-size" jobs. Now, you have more power to put to work. You can match the power of the new Caterpillar D9 Tractor with Caterpillar-built Scrapers and 'Dozers . . . you can push and pull more satisfactorily . . . you can 'doze or load more earth than ever before.

There is so much to tell you about the new D9 that you must see your Caterpillar Dealer soon. He has information that will open your eyes to new tractor performance. Ask him for the facts . . . check with him about delivery . . . get set for a new era of big tractor performance right now. The new Cat D9 Tractor is here!

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WALKER MACHINERY CO.

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LOOK TO **CATERPILLAR** FOR PROGRESS

COAL MINING

Vol. XXXII May, 1955 No. 5

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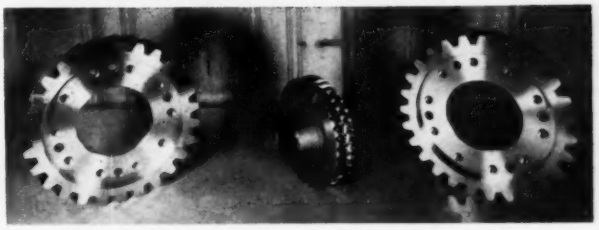

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unconditionally guaranteed

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ROLAGRIP Plain End Pipe Coupling

Manufactured in All Pipe Sizes
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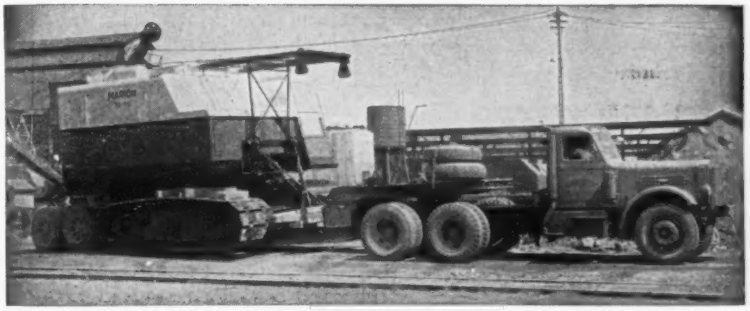
P. F. JASIK,
Publisher and Editor

MOVERS OF COAL STRIPPING AND CONTRACTOR'S EQUIPMENT



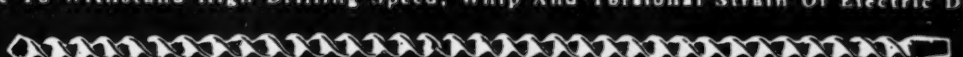
HEAVY HAULING • RIGGING

MOORE-FLESHER HAULING CO.

MOVERS of Coal Stripping and Contractor's Equipment
Preble & Adams Sts., North Side, Pittsburgh 33, Pa.
Phone ALlegheny 1-3600

SALEM "HERCULES" AUGERS FOR ELECTRIC DRILLS

Made To Withstand High Drilling Speed, Whip And Torsional Strain Of Electric Drills



Drills holes faster — Will not snap off shank or chip points — Outlasts four or five ordinary augers.

THE SALEM TOOL COMPANY SALEM, OHIO, U.S.A.

High Production and Lower Maintenance–

You Get BOTH with "Eucs"

Built for tough off-the-highway service, Rear-Dump Euclids have increased production and reduced hauling costs on scores of open pit mining and quarry operations. Ability to deliver "plus" performance year in and year out has made "Eucs" the accepted standard for comparison . . . here are some of the reasons why:

RUGGED SIMPLICITY

Designed and built for long life and low maintenance cost. All of Euclid's experience and facilities are devoted to specialized off-the-highway earth moving equipment.

CAPACITY

Euclids have payload capacities of 10, 15, 22, 34 and 50 tons. Because they are matched to various sizes of loading and crushing equipment, "Eucs" provide a well balanced operation for open pit haulage and increase the efficiency of the loading unit.

POWER AND SPEED

Powered by diesel engines of 125 to 600 h.p. "Eucs" have top speeds with full payload, up to 36 m.p.h. Five and ten speed transmission, or torque converter with semi-automatic transmission available. The favorable ratio of horsepower to payload means more pay tons hauled every trip.

VERSATILITY

"Eucs" are efficient for moving any material on any length of haul; handle overburden, rock, coal, ore and other materials loaded by shovels, draglines, transfer hoppers and mobile loading equipment.

If you are interested in higher production at lower cost, have your nearby Euclid Distributor show you what "Eucs" are doing on work similar to yours. He'll be glad to make a hauling cost estimate for your job—no obligation, of course.

EUCLID DIVISION
GENERAL MOTORS CORPORATION
CLEVELAND 17, OHIO

EUCLID "THE PIONEER"

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

GM GENERAL MOTORS

Do You Know?

● Within the lifetimes of those still in school, chemical science has brought atomic energy, antibiotics, new plastics, more riches from petroleum, and a thousand other things.

Advances are expected in the following fields:

Chemicals which feel cancerous cells, and chemicals which damage them, thereby helping the patient. Irritating chemicals which start cancers, and the body's response.

How bones grow, and how much of the living bone is rock-like crystal. What role phosphorus plays in the Chemical processes of life.

Relief for patients with high blood pressure, and methods for testing new drugs which will show the doctor the difference between effect of the drug and reaction of the patient.

Chemical pattern of drugs found helpful in treatment of disease symptoms, in both man and animals.

What can be learned about the cellulose molecule by taking it apart a little at a time. Application of this knowledge to improvement of wood, paper and photographic film made from cellulose esters.

How chemicals can change the make-up of soil, either to make farming better or to make firmer roadbeds and safer airstrips.

Aromatic chemicals, of the type made from coal tar and heavy petroleum residues, and how they can be used in industry.

Molybdenum, a metal coming more and more into use both alloyed with steel and compounded to from pigments and lubricants.

Many elements long known are proving capable of forming new kinds of useful compounds, making them exciting substances to chemists. Silicon, boron, tanum, zrconum and the so-called rare earths are among these. A symposium will be held to describe these and especially their compounds with hydrogen.

How atomic radiation makes plastic materials stronger will be discussed toward the end of the meeting.

What the chemist can do to receive stream pollution will also receive attention.

● A network of robot radar antennas monitored at a central station for evidence of enemy attack could be set up using a new system revealed here.

The development, reported at a meeting of the Institute of Radio Engineers, is a method to squash the radar screen signal so it could be transmitted on ordinary telephone lines. At present coaxial cables or expensive microwave relay systems are needed to carry radarscope pictures.

Taking advantage of the inherent repetition of radar signals from rotating antennas, the system can code the picture to fit in the limited band width of a telephone circuit.

The original radarscope image would be automatically scanned at 1/100 the speed of the projecting beam which would produce no significant loss of information.

Suspicious "blip" pictures, radar experts point out, could be transmitted for analysis from the central station to higher authorities anywhere in the world where there are telephones lines.

The device might also find use in transmitting continuous traffic information from one civilian airport to another, or to a central traffic control bureau.

C. W. Doerr and J. L. McLucas, of Haller, Raymond and Brown, Inc., State College, Pa., said reductions in band width in the order of 100 or 1,000 to one would be possible with the system. This means that the signal would take up 1/100 or 1/1,000 as much space in communication wires as conventional radar communicating systems.

Here and There in the Coal Industry

● S. Austin Caperton, Jr., chief engineer, has been appointed superintendent of Gaston No. 2 mine of the Slab Fork Coal Co. He will continue as chief engineer. Mr. Caperton is the son of S. Austin Caperton, a member of the board of directors of NCA and chairman of its Safety Committee.

Keynote address of the five-day diamond jubilee spring meeting of The American Society of Mechanical Engineers in the Lord Baltimore Hotel was sounded by David W. R. Morgan, left, president of the society and vice president of Westinghouse Electric Corp., Pittsburgh, Pa. Shown looking over the official program of the meeting with Dr. A. G. Christie, professor emeritus of mechanical engineering, John Hopkins University and past president of ASME, Mr. Morgan spoke at the president's luncheon meeting on the subject, "The Engineer's Responsibility in The World of Government."

● High quality diesel fuels with deposit-forming tendencies is obtained by treating fuel oil with zinc. This is the aim of an invention by Albert E. Brenneman of Westfield, N. J., who was awarded patent No. 2,706,149.

Mr. Brenneman found that fuel oils, and particularly diesel oils, can be made to have low deposit-forming tendencies when contacted with zinc and containing sulfur compounds of from 0.3% to 0.5%. The treated fuels, the inventor points out, can also be used to advantage in gas turbines and boiler furnaces.

Patent rights for the feul oil treated with zinc were assigned by the inventor to the Esso Research and Engineering Company of Delaware.

● Frank R. Amos, vice president and general counsel of Pittsburgh Consolidation Coal Company, will retire April 30, 1955. Mr. Amos has served as vice president since 1948. Prior to that time he was consulting counsel for the company in West Virginia. Mr. Amos, upon retirement, will be associated with the law firm of Thorp, Reed & Armstrong of this city, and will act as associate counsel for Pittsburgh Consolidation Coal Company.

John Corcoran, an assistant vice president since 1950, succeeds Mr. Amos as vice president and company counsel. He came to Pitt Consol from the Pittsburgh legal firm of Rose, Rose & Houston.

● I. W. Rouzer, Birmingham, Ala., president of the Alabama Mining Institute, has passed away. Mr. Rouzer had been associated with the railroad and coal industries since 1910. For the past 20 years he had headed the Mining Institute, representing all mining interests in Alabama. Mr. Rouzer had also been head of the soil pipe industry for many years, serving as president of the Soil Pipe Association, and he had also served for a time as sales manager for Sloss Sheffield Steel & Iron Co. He also worked for the Atlantic Coast Line Railroad. Mr. Rouzer was well known throughout the South and will be greatly missed by his friends and associates.

Jeffrey Belt Conveyors carrying coal to the Lady Dunn Preparation Plant of the Cannelton Coal and Coke Company, Cannelton, W. Va.

NATURE — MAN — MACHINE

● It is no new thing for the coal mining man to be confronted with difficulties. The coal man has always faced uncertain futures. By sharing together this present great adventure into the unknown with wisdom and determination he will win the present race between catastrophe and the full automation of his mines.

Being made up of living matter developed by nature on this earth and having to depend entirely on natural phenomenon, it will help better understand how man can bring about the automation of his mines if he understands how nature brought about the full automation of the animal body.

Life on this earth is the result of millions of years of consistent and persistent organization and reorganization of matter by nature. Study has shown that matter is constantly organizing matter and that some lifeless matter attains considerable complexity that gives extraordinary reactions based on regular principles of operation. In the early development of our species the farthest advanced matter took on a semi-conscious entity to give it what we call living quality. The interior of living things consists of complicated organs, tissues, cells, then cells of parts within cell parts, intrically arranged into groupings and subgroupings. It is the orderly workings of the complex parts on which life itself depends. The more operations of living things are

traced to the orderly workings of parts, the more clearly it is seen that they depend on one integrated system for their operation.

The question uppermost in present man's mind is how did these parts and their proper operation come into being. Their process of origination had to have some kind of conscious direction. Some schools of thought speculate that ancestral organism had been endowed with built-in, long range abilities that helped them evolve as they did. Thus living things acquired adaptive ability to alter themselves when they were subjected to change and implanted into their reproductive cells the means for alteration of the specie. Offsprings inherit variations that are conducive to survival and multiplication, accumulating characteristics advantagious to the specie.

The factor of natural selection in life is the gene. Thousands of different genes in a cell of animal or plant have a distinctive pattern and special type of chemical influence. Genes are strung together in threadlike bodies called chromosomes in the nucleus of the cell. Through their diverse products they control the composition and arrangement of most all other material in the body. Discoveries recently began to indicate that the gene consists of a coiled chain or double chains having thousands of four kinds of links which, through different arrangements, make possible unlimited numbers of kinds of gene. Each chain molecule of the gene can capture chemical groups which correspond to these links, constituting another gene like itself which makes it possible to reproduce itself.

It is reasonable to assume that the existence of evolution is due to mutant genes that had naturally been selected for their chemical tools which were most useful for their survival and multiplication. The essence of life lies in the capability of undergoing evolution which is inherent in the gene and which is capable of duplicating its variations. Natural death in living things gives genes the opportunity to pass on to newer generations selected improvements they have developed.

Divergent forms resulting from advances in different groups were the result of adoption to different circumstances. Some of the originally adopted forms were temporary but became important parts of the pattern of the organism. Having many imperfections of structure and functioning, evolution appears to have been more opportunistic than foresighted as it presents curious combinations of imperfection and arbitrariness.

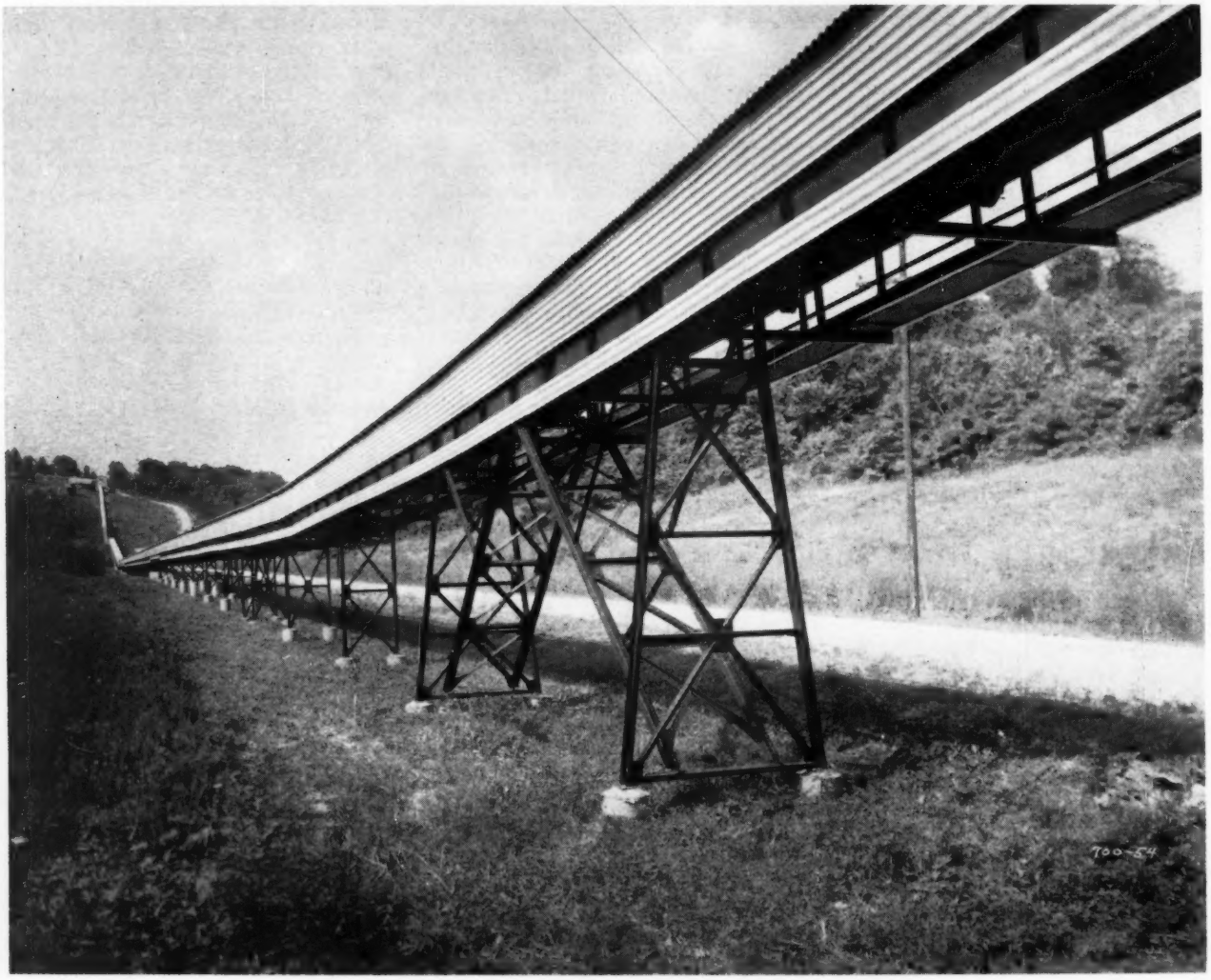
At one time in early evolution organism adjusted itself for movement which enabled it to capture and assimilate organic materials for its existance. This predatory mode of life encouraged the development of a means of locomotion which resulted in animal. The bigger the animal grew the more of the concentrated form of food he required, the more adroit and stronger became his means of locomotion to obtain his food and to keep from being eaten by other animals. Plenty of good food brought on elaborate systems for ingesting, processing food and oxygen for the body and for eliminating wastes.

Inclusion of mechanisms in the adjustment of individuals for modifying operations in its elaborate system of operation regularly occurred in the development of higher active animals. Included in the basic feature of this process was the formation of connections between nerve cells which might be called learning or association. Analysis, another essential of learning, which separates particular components existing in a neuronic reaction-complex so that when components occur in different arrangements they are cross-connected to give the desired result. Modifying processes are useful to organisms because of their effect on behavior. Modification of the species becomes possible by neuronic activities which are strengthened by experiences designated as desirable. Evolution shaped the neuronic activities of the creature in working for its betterment. Learning through association it achieved its desires through better adjustment to circumstances surrounding it. Total gratification was by learning to coordinate its different desires to one another.

The accummulation of man's native intelligence is the result of his ability to vocalize and symbolize which enabled him to communicate with others of his kind. This provided him with ever increasing experiences of his ancestors and of his associates. Commulative knowledge and the resulting material equipment based on that knowledge have made man incompatibly more potent than any other form of life on this earth. Using conscious, organized knowledge and rational judgement man is ever more reaching new modes of existance.

At present man's social development is far behind his material

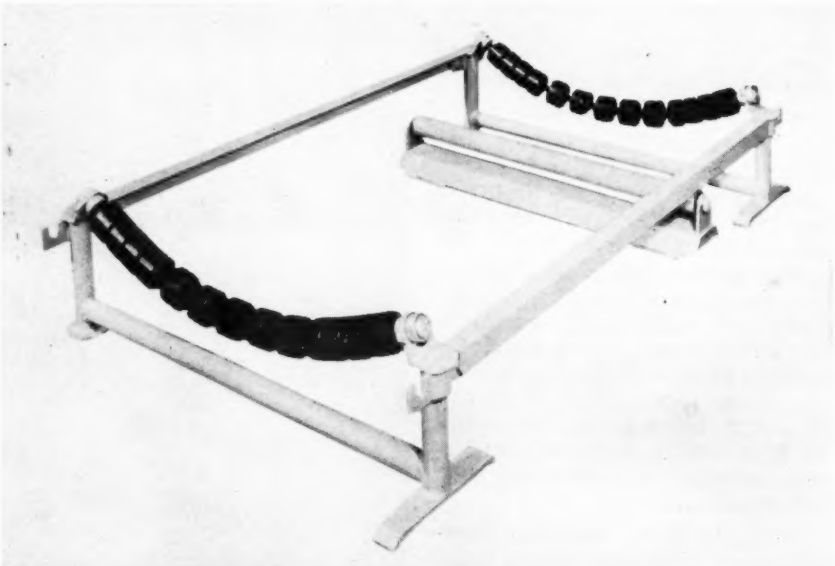
Coal going to the tipple in gallery Cannelton Coal and Coke Company.



Jeffrey belt convevor carrying coal overland at the American Gas and Electric Company, Beverly, Ohio.

development. This is resulting in inefficiency through non-cooperation among his own kind that at times inhibits his hard won achievements. Man can, and no doubt will, advance to unimagined conquests. Advance will require wisdom, gained only from free inquiry, based on solid advancing knowledge of nature founded on unbiased good will.

Biological means today have made it possible for the gene to progress incomparably faster than when progress was limited by the slow unconscious processes. Success in the pursuit of happiness of man is the basis for the success of the gene in its job of multiplication. If man is to utilize his opportunity for good of his kind and minimize risk of disaster, his gene must be directed toward proper biological expansion. Civilized



Joy Limberoller, shapes conveyor belt to load. Has only 2 sealed ball bearings. Rolls are neoprene which is resistant to corrosion, abrasion, flame and oil.

man and his social evolution however is allowing an accumulation of detrimental mutant genes (those that are weak or ailing by heredity) in his artificial saving of lives that would not be allowed to happen by natural selection under primitive conditions. In man made machines such a condition will never come about for he will discard all weak and misfitting parts, thus enhance his position in the universal struggle for existance.

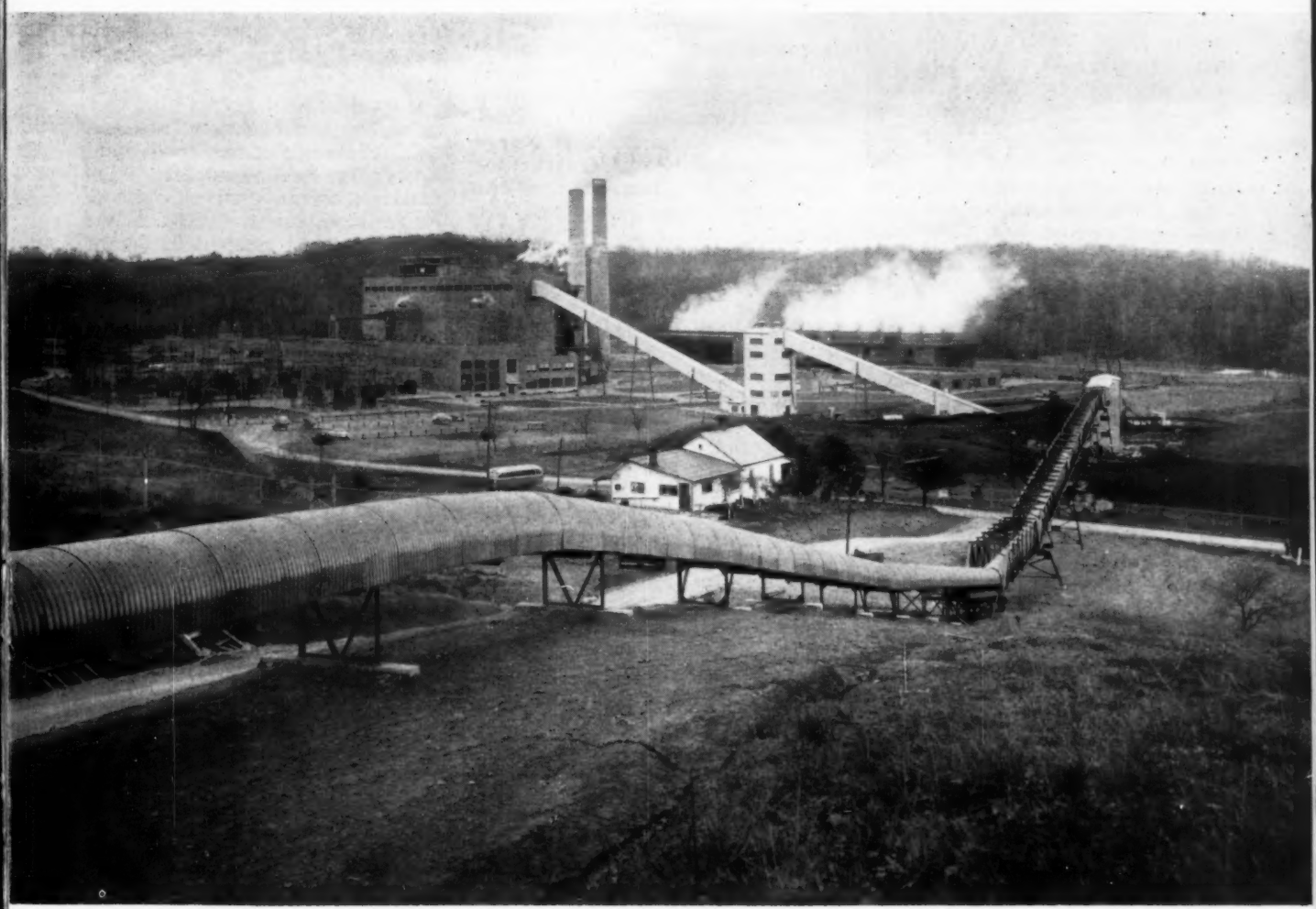
At this moment in the genes millions of years of progress, the dead hand of ancient supersition is haunting man and is keeping him from enjoying a much greater life. Enlightenment will dispell that fear in time, however, and man as he is known today will be a transitional operative in the progress of life. Evolutionary methods will go from the unconscious to the concious, from trial and error to long range foresight for the law of the gene is to ever evolve to forms that will effectively control materials to safeguard its own increase.

Turning to the problem of developing automatic machinery for the production of coal, we find that with the invention of the machine came the possibility of making entirely lifeless matter engage in remarkable activities reminiscent of those of living things.

We have had some time now photoelectric cells that count and sort things and open doors automatically. Recently the electronic computer was developed which solves difficult mathematical problems in seconds or minutes. An electronic computer may have 5,000 or more tubes which act as a brain and do its thinking. Man's brain contains a hundred or million cells developed over several hundred millions years, connected to highly intricate system of nerves, therefore, it probably never will be possible to build a machine that will perform all the functions of man because he is too versatile. It is now possible to make a product from the raw state to the finish without the touch of a human hand. Men working on computers and electrobots believe that it is theoretically possible to build a machine that will reproduce itself. One of the scientists has gone so far as to say that it is not utterly impossible to build a machine that will not only reproduce itself but will improve itself, producing a mechanical equivalent of what happens when living creatures mutate into higher forms.

Under our present shackles of ancient superstition and authoritarianism it is only reasonable to believe that the ever evolving gene in man will enable him to improve his imitation of life, the machine, much faster than he will improve himself.

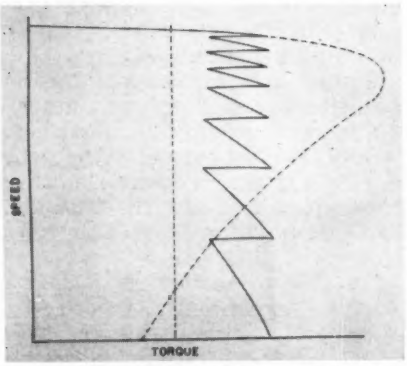
Geared to effortless, smooth working operations, guided by electronics, the mining of coal will have a part in this dynamic economy known as America, heading for distant and unknown horizons.



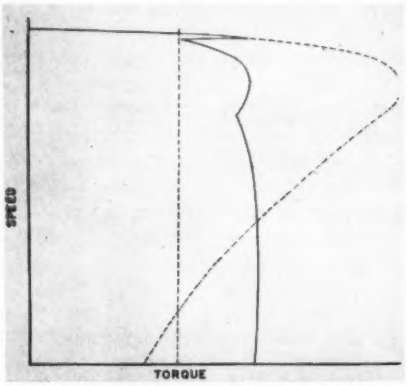
Panorama view of Porter Electric Generating Plant showing 24 inch Jeffrey belt conveyor approaching plant from mine 1¼ miles away.

A CONSTANT TORQUE STARTER FOR WOUND ROTOR MOTORS*

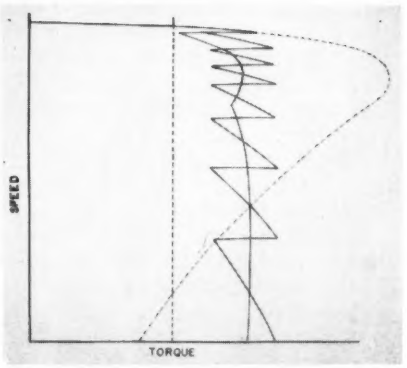
BY R. W. EGGLESTONE
Control Engineer
Westinghouse Electric Corporation



8 Point Secondary Resistor Control
Fig. 1



3 Point Secondary Resistor Reactor Control
Fig. 2



Comparative Speed Torque Characteristics
Fig. 3

A constant torque starter on a wound rotor motor controls the motor torque to a nearly constant value during acceleration. This is desirable on many drives and especially desirable on long belt conveyors. The value of torque is chosen to protect the belt against damage due to slippage of the drive pulley and excessive tension.

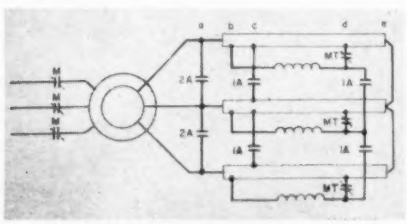
The speed torque characteristic, fig. 1, of a wound rotor motor with a conventional eight point secondary control illustrates the minimum torque variation which can be obtained by providing eight speed torque curves, one for each point of secondary control, and transferring from one curve to another at the proper speed. If the speed of transfer is not exactly correct, either the maximum torque will be increased or the minimum torque will be decreased. The vertical dotted line represents motor rated torque. For an eight point secondary control with an average torque of 150 percent the maximum torque would be 170 percent and the minimum torque 130 percent. To obtain a smaller differential between minimum and maximum torque with secondary resistance only it is necessary to add additional points, thus allowing each point to cover a smaller speed range.

The speed torque characteristic of a three point resistor reactor control, fig. 2, shows that torque of approximately 150 percent is obtained over the entire speed range. The first point provides acceleration to 75 percent speed, the second point from 75- to 95-percent speed and the third point to running speed.

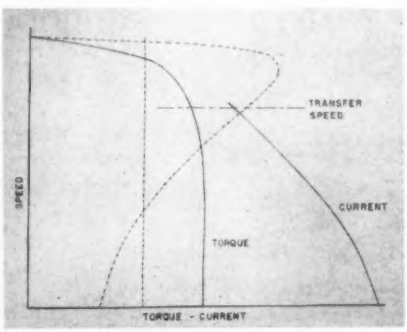
If a comparison is made between eight point conventional control and the three point resistor reactor control fig. 3, it is apparent that the speed torque characteristic of the resistor reactor control is far superior. The schematic power circuit of the motor primary and secondary for the first point of acceleration with resistor reactor control is shown in fig. 4. The primary control is a single, 3-pole linecontactor, thus allowing the control to be used economically with either high voltage or low voltage power supplies.

The secondary circuit provides a parallel resistor-reactor circuit between points b and d. The rotor frequency changes during acceleration and, due to the change of frequency, this parallel circuit provides a change in equivalent series resistance and reactance. This can easily be seen by assuming an ex-

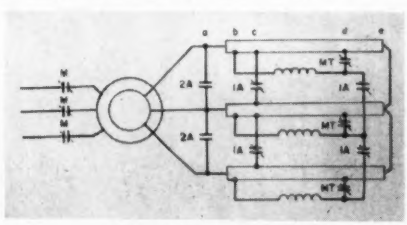
*Presented at the 5th Biennial Materials Handling Conference, sponsored by the Westinghouse Electric Corporation; Columbus, Ohio, February 1 and 2, 1955.



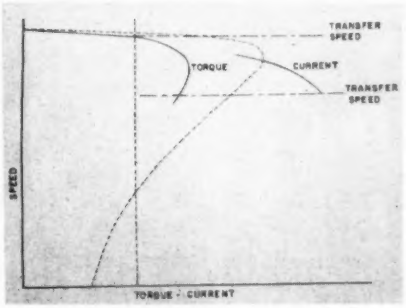
Circuit For Point 1
Fig. 4



Torque and Current Characteristics Point 1
Fig. 5



Circuit For Point 2
Fig. 6

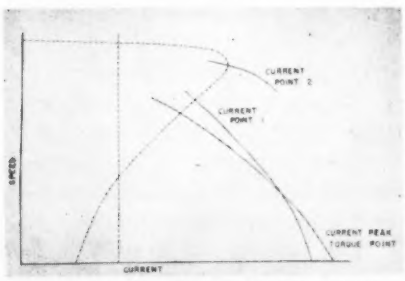


Torque and Current Characteristics
Point 2
Fig. 7

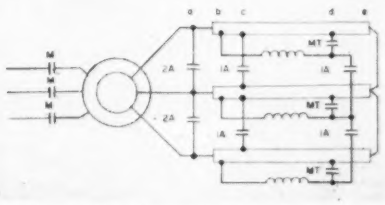
treme change in rotor frequency of zero to infinity. For the condition of infinite frequency the reactance of the reactor would be infinity and would carry no current. Hence, the equivalent series impedance of the parallel circuit would have a value of resistance equal to that from b to d. For a zero value of frequency the inductance would be zero and all current would flow through the reactor and the equivalent impedance of the parallel circuit would be zero for both reactance and resistance.

From zero to 75 percent speed, the rotor frequency varies from line frequency to 25 percent line frequency. The frequency change for a 60-cycle motor would be from 60 to 15 cycles. Therefore, the first point of acceleration is made with a continuously decreasing secondary resistance. The secondary resistance from a to b plus resistance from d to e is in series with the resistor-reactor parallel circuit and improves the shape of the first point speed torque curve shown in fig. 5. The line current for the first point of acceleration is also shown in fig. 5 with the locked current being approximately 300 percent for 150 percent starting torque and falling off rapidly with acceleration.

The circuit arrangement for point 2 of the acceleration, fig. 6, is obtained by closing the 4-pole contactor 1A. This acceleration



Current Characteristics All Points
Fig. 10

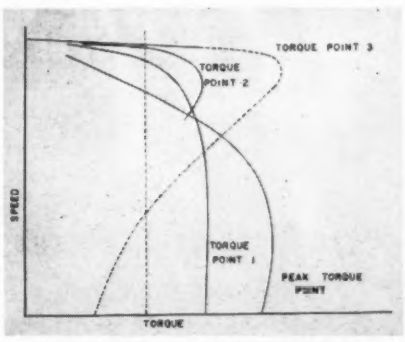


Circuit For Maximum Torque Point
Fig. 8

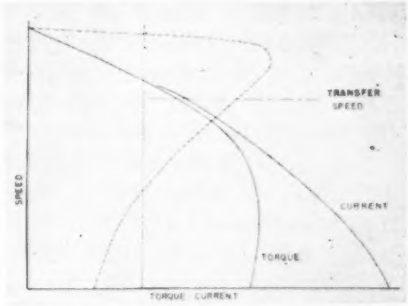
contactor forms a star point at c for the phase resistors and a star point for the reactors at b. Since no potential exists between the star points c and d, the reactors are effectively in parallel with the resistances between points b and r. Resistance from point a to point b is in series with the new resistance-reactor parallel circuit.

The speed torque and speed current characteristics of point 2 is entirely different than for point one. The rotor frequency at the start of point two is quite small and little effect is obtained due to the change of frequency. The maximum torque of point two is obtained by controlling the equivalent series reactance in the resistor-reactor circuit. By again going to extreme values, it may readily be seen how resistance would be zero. The pull-out torque under this condition would be the pull-out torque of the motor.

With a value of infinite resistance between points b and c, all the current would flow through the reactor and the equivalent series reatance would be equal to its actual reactance. The reactor value is such that if its full value was effective, the pull-out torque would be considerably less than the desired torque. By choosing the proper value of resistance between points b and c, the maximum value of torque desired may be obtained. Resistance between points a and b determine the speed at which the maximum torque is obtained and is



Torque Characteristics All Points
Fig. 11



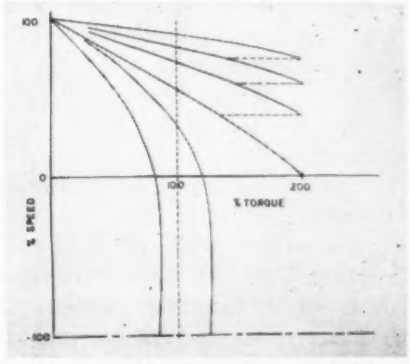
Torque and Current Characteristics
Peak Torque Point
Fig. 9

chosen to give the best torque characteristics for acceleration between points 1 and 2.

The third point of acceleration is obtained by closing contactor 2A which shorts the rotor and provides the running point.

A resistor reactor control of this type is now being built for a 500-hp wound rotor motor having a 4160-volt primary. The control is for a belt conveyor at a mine. This control also includes a peak torque point with secondary circuit fig. 8, and torque characteristics as shown in fig. 9. The peak torque point is obtained with contactor MT open, removing all reactance from the secondary circuit and obtaining the maximum torque curve with all resistance effective. The peak torque point in this arrangement is determined by the pull-out torque of the motor but could be reduced to smaller values by shorting out one or two of the poles on MT contactor. The current characteristic of all points in relation to speed is shown in fig. 10, while fig. 11 shows the torque characteristics of all points in respect to speed.

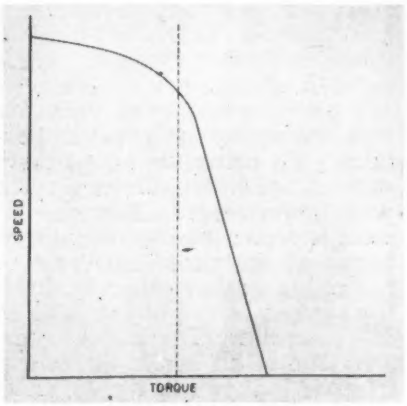
The control is designed to obtain the value of acceleration torque desired, depending on the application. The maximum value for a



Constant Plugging Torque Control
Fig. 12

control cannot exceed 70 percent of the pull-out torque of the motor. There is no limitation on the minimum torque design in respect to the motor's pull-out torque.

The resistor-reactor control is effectively a method of obtaining the desired speed torque curves and is not limited to constant torque acceleration. Curves may be calculated, fig. 12, where it is desirable to have two values of constant plugging torques, obtained respectively on the first and second points of the master switch with four points of standard secondary resistor control. This control would provide approximately 85 percent constant torque from 100 percent negative speed to zero speed on the first point plugging, and a constant torque of 125 percent over the same speed range on the second point.



Special Speed Torque Control
Fig. 13

A single point secondary control fig. 13, can be used where it is desirable to provide approximately 100 percent torque at 80 percent speed with a limited maximum torque increasing to approximately 160 percent torque at stall.

Belt conveyors provide an economical method of handling many bulk materials and their use will certainly continue to increase. With the possibility of conveyor system such as the River Lake conveyor in Ohio and the conversion of other bulk handling methods to belt conveyors, the resistor-reactor constant torque starter should prove to be a valuable tool.

Mine maintenance equipment can get a quick start to the scene of trouble from the mine machine shop to any emergency. MinePhone contacts with all trips can clear the haulagewav immediately if necessary.

Operating Track Haulage System Without Dispatcher

A track haulage system operating without a dispatcher is one of the many features of the Saginaw Dock and Terminal Company's fully mechanized coal mine near St. Clairsville, Ohio. Daily capacity of the mine is 3000 tons of Ohio No. 8 coal, most of which goes into power plant boilers.

Motormen on seven haulage trips and two self-propelled supply and personnel cars, when the latter are in use, are in continual and direct contact with each other and are thus united into a cooperative team which maintains high efficiency hauling coal over the mile of single track to the conveyor belt hopper near the mine entry.

This effective and economical teamwork is made possible by ten MSA Mine Phones carried on the mine haulage units and one spare locomotive. Two additional mantrip jeeps which are on order will also be equipped with MinePhones. Unlike conventional telephones the MinePhones operate on a high-frequency FM carrier wave which is transmitted by the trolley power line. Electrical circuits screen out the static produced by commutator motors, trolley arm contacts, and other sources.

The MinePhone system is completely independent of a conventional system of 13 telephones dis-

tributed over the mine property. However, messages can be transferred readily from one system to the other when necessary, because a MinePhone is always close to one or more of the telephones. Such messages may be either from above ground to any point in the mine, or from any point in the mine to any of the five telephones above ground. Although transferred messages are rare, they might pertain to supplies, maintenance work, or emergencies of any kind including accidental injuries.

Saginaw engineers solved their haulage communication problems before the mine was opened in 1950. The original plans for mining operations included MinePhones from Mine Safety Appliances Company, along with other modern mining equipment such as continuous mining machines, belt conveyors, bottom dump coal cars, self-service lamp distribution system for Edison cap lamps, and a modern high-speed cleaning plant. Specifications for the mobile communication equipment resulted from a similar solution of haulage problems in another mine operated by the company.

The coal haulage system consists of seven haulage trips, each having a capacity of 35 tons of coal carried in seven drop-bottom cars. Three of these trips are always being loaded under three belt heads delivering coal from three mine faces. Two are usually moving toward point on the 5400-ft. main line and or away from the single run-around the remaining two are waiting to move under a belt head as soon as it is vacated by a loaded trip. Supplies and personnel can travel over the system freely without interrupting coal production because the use of MinePhones permits their movements to be coordinated with coal trips.

One of the features of the haulage system and mining operation plan is the fact that it is necessary to run empty coal cars in and out of mine branches. Trips are loaded on sidings paralleling the main line from conveyor belts running through the branches. Five continuous mining machines at three mine faces deliver coal to shuttle cars that feed the conveyor belts.

Although the MinePhone system was installed for the single purpose of providing for efficient haulage, it has proved to be advantageous in other ways, according to Richard Graham, mine superintendent. Any breakdown of either moving or stationary equipment along the line can be reported instantly so that a maintenance crew with proper tools can start repairs within minutes if necessary. In some instances this speedy method of reporting trouble may prevent more serious failures of equipment or, if a man should be injured, assure quicker medical attention. Motormen appreciate the constant assurance of safety by knowing at all times the location of other haulage trips. Elimination of the hazardous and time-consuming practice of jumping on and off their motors to get such information from stationary telephones also has given satisfaction to the motormen.

As production operations move farther from the mine entry the advantages of MinePhone communication increase. A second run-around presently is being built so the main line can accommodate more traffic efficiently.

Maintenance of MinePhone equipment is simplified by the use of replacement units on trays that may be exchanged readily with a spare. Only other duty of mine mechanics in connection with the MinePhone program is checking and replacement of vacuum tubes. Any additional servicing is handled by field service men of Mine Safety Appliances Company.

Before starting with a load of coal from the belt head, motormen pick up MinePhone transmitters to report their readiness and check positions of other traffic on the main line. His voice simultaneously reaches all other trips in the mine through loud speakers, like the one shown in the foreground.

Any delay along the main line is instantly reported, holding other trips back until the track is cleared for coal haulage. MinePhone loud speaker is mounted in front of the box containing electrical circuit equipment, which is beside the lunch box.

AXES, AXLES AND ATOMS*

BY R. C. SOLLENBERGER
Executive Vice President
Conveyor Equipment Mfg. Assn.

If you have ever worried over the length of time your engineering department has taken to develop some new gadget containing no more than a thousand parts and which will do no more than merely revolutionize your industry, you can draw some sour comfort from reflecting that our primitive Stone Age ancestor took somewhere from 500,000 to a million and a half years to fit a wooden handle to his stone axe.

Of course, during this time he brought out a few by-products such as when he accidently chipped a hot flint spark into a pile of dry leaves paving the way for the modern cigarette lighter. And later, a chunk of charcoal from this same fire put him in business as the first draftsman.

I have a mental picture of our Paleolithic friend humped over his stone drawing board, reflectively nibbling on his charcoal pencil for some 20 or 30 generations and then —Eureka—the first idea for an axe handle. This revolutionary idea may have been turned down as visionary and impractical by another 10 generations of bosses until, in despair, our genius takes the plunge into the axe handle business for himself.

About this time things began to pop, for the Second Stone or Neolithic Age lasted a mere 7,000 years. It was during this time that village life began and along with that came, most likely, our first traffic jam. Our ever-so-great-grandmother dropped her bearskin Schiaparelli and donned her first woven creation. The first wheel rolled down a prehistoric hillside, but was not thought to have any practical application for many generations to come. Perhaps the most significant development of all time was that man was beginning to exercise some control over his environment—proctection from the weather, storage of food and fuel against the winter, and mutual aid to fight off his enemies or to get things done.

The next four or five thousand years saw the advent of metals, tools, communications, mathematics and the application of basic mechanical principles, cultivation of the land and irrigation, to name but a few. Communism as we know it today existed in an almost identical form during this period with its ruling few, its enslaved masses, and its state monopolies of ship building, mining, weaving, and commerce. Early Egyptian history tells in detail of this system so don't let anyone ever say that Communism is something new.

Now consider that within our own life span we have passed through the Mechanical Age, the Electrical Age, and are well started in the Age of the Atom. One can't help but wonder where we go from here. Perhaps with all of our devices to give us freedom from fatigue and a great deal more time to think, we will enter an age of mental development during which our progeny may learn to utilize the fantastic latent mental powers that sleep in all of us.

I think it was a Richard Franck, back in 1658, who coined the old phrase about necessity could claim any closer relationship than that of a stepmother. I'm sure that the real mother of invention is Simonpure, bone-tired human laziness human trait, pampered it through and we have nurtured this most the ages until physical effort WITHOUT enjoyment is almost extinct. How often have you walked TO the golf course?

"Laziness" ties in more directly with mechanized handling than with almost any other facet of our modern way of living. Materials handling with human muscles is pure drudgery and who wants to be a drudge if there is any other possible way of making a living?

Another basic reason for the expanding use of machinery for handling and other menial jobs is the sense of satisfaction to the machine operator even though he may not even realize what he is getting. Only a few men have the opportunity of exercising leadership over other men, but almost any dub can learn to lead a machine, to become its master. I still envy the chap at the controls of a giant power shovel; or the guy running a bulldozer, but I certainly don't envy the sodbuster with his shovel.

Mechanization breeds more mechanization and there can be no turning back of the clock short of complete disaster or annihilation. That's true of production machinery, of farm machinery, of materials handling machinery, and even of household appliances.

We are in an age of robots. Science fiction writers love to picture a robot as something made more or less in the shape of a man and they forget that man, as a general-purpose sort of type, has many facilities almost any of which are inferior to those of animals or even insects. He does have a perfect materials handling tool in his two hands, but is handicapped there by lack of strength.

We live constantly with robots and most of us seldom realize how they assume responsibility and smooth the way for us daily. They come in almost any convenient shape or size and they can out perform by far the most sensitive and skillful human within the limits of their assigned responsibility. I'm speaking of the little man who feels cold when your living room gets chilly and turns up the furnace; or the little chap in the refrigerator who maintains the temperature at any point you may set it and keeps you in ice cubes; other little men who change records on your phonograph, regulate the charging rate on your car battery,

*Presented at the 5th Biennial Materials Handling Conference, sponsored by the Westinghouse Electric Corporation; Columbus, Ohio, February 1 and 2, 1955.

shift your gears, help your wife make a roast or bake a cake, warn of fires and then put them out; or they may even close your windows in the event of a sudden shower, or put up the top on your new convertible.

We have machines now which can not only duplicate each of the five human senses but can also extend the range of sight and sound into frequencies far beyond human perception. They can make objects known to us even though we may be hundreds or thousands of miles distant.

Our seeing devices may translate what they see directly into pictures as in television so that an operator may control a conveyor, a crane, a fork truck, or other handling devices from the safety and comfort of a point far from where the work is being done. Or they may translate what they "see" into signals which make up their own exclusive language and which, in turn, operates mechanisms to perform the needed tasks. They can sort things by colors with variations in shade imperceptible to the human eye; or by shape, or other variation.

They can look into furnaces; maintain an unblinking, twenty-four hour watch to instantly report on danger from almost any cause from fires to enemy bombers; turn our street lights on when daylight drops to a certain level and turn them off again at sunrise the next morning. Recently, someone introduced a machine which can literally read a foreign language and translate it into English.

Our ears become equally acute so that the slightest variation in sound becomes an instant warning or sets in motion machinery to correct whatever may have gone wrong. We have machinery that can feel differences in fractions of tens-of-thousands of an inch; or tell the slightest variation in pressure or weight. Other devices can literally smell smoke, or dangerous gases and they could be made to "smell" almost any odor that could be used as a basis for automatic control. We even have machines that can differentiate between the taste of different materials. Still others have extra-sensory perception to detect radiation or to see in the dark; and some have fantastic memories for figures or other data. About the only thing no machine can do is to exercise reason and wisdom, although some unkind souls have said that about humans too.

All of these extensions of man's senses can and will be applied to his automatic devices. You hear now of automatic order filling from a warehouse containing thousands of items. It is possible for a machine to make up orders from bulk storage of solids or even liquids. I can see where some limitations might have to be built in if selection was to be a matter of tasting, otherwise, for example, in a bonded liquor warehouse you might find the happiest truck in the country.

The Age of the Atom opens up whole new vistas for development and, of course, brings with it a whole new series of problems. The dangers of radiation have spurred the development of a great many handling devices to permit operation from remote control points. Some of these devices can be controlled with such delicacy that they can perform operations at which the most dexterous fingers would be capable.

Here is something that will be applied to the handling of other less hazardous materials, but which still present problems where humans must come in contact with them. It seems certain that more and better protection for the workman is on the way through better and more automatic mechanized handling machinery.

We have machines that can remember and we also have machines that can learn by experience. Perhaps you read of the "electronic mouse" that could be turned loose in a maze and, after a period of trial and error, could reach the exit. It could then always return to that exit along the shortest path and could even hunt its nest when its batteries needed recharging.

Perhaps this principle can be applied to a materials handling device that will find its way around a plant, picking up and delivering materials as it goes along. If human supervision is needed, radio control is sure and simple and the device can easily carry its own eyes to tell the operator exactly what it is doing at all times. If necessary, it can carry its own ears to relay audible information back to the operator.

It's quite possible that overhead cranes and hoists will be operated by remote control with the crane hook or magnet carrying its own eyes and possibly its own ears if it happens to be operating in hazardous areas. Many cranes will become manipulators instead of just lifting and carrying devices.

Even now we have storage bins that will tell an attendent by radio how much material they contain and that attendant doesn't actually have to be human to start and stop the machinery that keeps the bin filled to a certain level.

Conveyors are becoming combinations of mechanics and electronics and in a lot of cases the control apparatus may almost hide the conveyor. You have probably read of many ways in which conveyors are being adapted as automation devices for almost an infinite variety of purposes so I won't say much about this field in which enormous development can be expected.

There are two other fields in which conveyors are bound to expand: the long haul for bulk materials and even packaged goods; and shorter hauls for passengers. To some extent the rapidity with which both areas develop will depend on public acceptance. We know the public is becoming conveyor conscious to a marked degree when cartoonists use conveyors as symbols of continuous production; or when a congressman compares the flow of secret information out of the country to a conveyor belt line; or when a reporter calls an old-fashioned bucket line putting out a rural fire a "human belt conveyor."

Eventually, you will see conveyor lines handling bulk materials for hundreds of miles where the economics of the situation justify the installation. Justification for conveyor lines is apt to show more readily than one might think. Certainly such transportation will be considered wherever there exists the twin factors of a continuous supply of material at one end and a continuous demand for that material at the other end. The much publicized Riverlake project over 103 miles of the state of Ohio for handling ore southbound and coal northbound is an excellent example of economic justification. The only obstacle to this line is political and I doubt if that one can stand permanently against the array of facts and figures in favor of the conveyor line.

Cleveland is considering a belt line of conveyors to eliminate the traffic of lake boats up the river with the consequent inconvenience to street traffic when forced to wait while the draw bridges are open. Another possibility is a conveyor line by-passing the canal at Soo Ste. Marie. The conveyor would be far less vulnerable in case of enemy attack than the locks.

In mountainous country, conveyor lines can be built for a fraction of the cost of either highways or cost per ton-mile than either. Such railroads and then operated at less lines will be used in bringing out ores and minerals to processing plants located at convenient points. Surely, the matter of transportation of bulk materials by conveyor has scarcely started to develop across country and from remote areas.

You read a great deal about the so-called "downtown blight" in cities which is due partially to overflow of population to the suburbs, but mostly to the fact that too many people have to move in and out over streets laid out for horse and buggy traffic and they don't like it. A lot of the congestion is caused by deliveries of the things these people need in their work or of the things they buy. As long as this traffice must be carried on a single level, temporary relief is all that can be expected. I believe it perfectly feasable to eventually adopt the principle of continuous-flow for deliveries from suburban air, rail, and truck terminals. Such flow could be maintained either below or above street levels. If below, the tunnel would not have to be much larger than those for sewer lines or those for other utilities. If overhead, structures would be light and could be designed to blend well with the architecture of the areas through which they would pass.

There has been considerable talk about conveyor lines paralleling railroad tracks on the railroad rights-of-way and owned by the railroads. This seems to me to be an eminently practical suggestion and one that almost any railroad could well afford to study. Such lines could haul bulk materials, or packaged goods up to a substantial size and weight.

The one technical development sure to come is that of intermediate or booster drives for belt conveyors which would eliminate the present limitations on lengths of single flights imposed by the tensile strength of the belts. When that happens you will see single belts miles in length just as you have seen in the case of trolley conveyors where there is no real limit on the length of chain that can be used in a single conveyor.

You can scarcely pick up a magazine or a newspaper these days without reading something about passenger conveyors. Here, again, is a development that had to come, but it had to wait on public acceptance forced by public necessity. Millions of people ride on thousands of conveyors daily and few realize that they are on a conveyor every time they step on a moving stairway. Other thousands of workmen ride man-lifts daily and don't realize that they are riding on vertical conveyors; thousands of skiers ride to the mountain tops on cableways, ski tows, and car tows and don't know that they have ridden on conveyors.

Horizontal passenger conveyors have been known since 1893 where a form of slat conveyor first appeared at the Chicago World's Fair —the first vertical passenger conveyor in the form of the man-lift appeared in 1887. A conveyor installed in the Chicago Museum of Science and Industry has carried well over two million passengers since it was put in. The first commercial installation went into operation on May 24, 1954, in Jersey City, with a capacity of 10,800 passengers per hour. It is interesting to note that 9,000 people per day caused pedestrian jams in this same tunnel before the conveyor was installed.

I am told that the cost of power to the conveyor on this installation is less than the cost of electricity to the overhead lighting system. The ancient shuttle trains between Grand Central and Times Square in New York will carry something like half again as many people hourly and eliminate waiting at the same time.

One of the large manufacturers has installed a passenger conveyor to speed the flow of people into and out of the plant. Many installations have carried passengers for many years in industrial plants where workmen ride beside their particular operation as it moves down an assembly line; foundrymen for years have poured castings from moving pouring walks synchronized to the speed of the mold conveyor. Conveyors to move

Jeffrey type 61-W room or gathering conveyor in coal mine.

Jeffrey belt entry conveyor in coal mine.

workmen to the job would seem to be economically sound in these days of portal-to-portal pay for they will cut travel time to the job wherever congestion exists.

Industry found many years ago that a comparatively small, but continuous flow would deliver astronomical tonnages during a day's run. Industry, commerce, and government is just now discovering that the principle of continuous flow can be applied to the movement of people with just as startling results.

One reason fringe parking lots never catch on is the slow and unsatisfactory transportation to downtown stores and offices. I think continuous flow would be accepted by the public since waiting would be eliminated and such conveyors could be protected from the weather. In some centers they could ascend several floors above the street level and pass right through store buildings and offices, jumping from one to the other over lightly constructed, decorative bridges. I can envision cities where a shopper or an office worker after leaving the parking lot would not need to descend to the street level until he returned to the car in the evening.

Airlines and railroad terminals offer another broad and fertile field for continuous-flow movement for both passengers and their baggage. Here conveyors would emancipate the passenger from the redcap for most could and would handle their own baggage. This would eliminate the wait for baggage at an airport where the time spent in standing around can easily exceed that spent in flying on short trips.

If you have ever sweated up interminable ramps at a ball park on a hot summer afternoon, you will appreciate the fact that at least one major park is seriously considering reversible ramp conveyors to end the congestion before and after the games.

Commercial applications appear to be literally without end and they include transportation for customers of super-markets to and from their super-parking lots. Soon you can get out of shopping, for your wife won't need you to carry out the sacks of groceries. You may even save money, for it seems to be notoriously true that hubby always grabs a lot of extra items that he spies as he trails along back to the meat counter.

Editorial writers have picked up this development and those I have seen so far have viewed with alarm the thought that this is too much comfort for the American people although Dr. Brownell of Columbia University says he is in favor of any conveyor which will speed him out to the golf course. They all seem to have missed the main point behind passenger conveyor installations.

That point is simply that they offer a means of ending pedestrian congestion by providing continuous-flow and the comfort angle is secondary although it, too, will be important to a lot of people—those handicapped, the plain lazy folk in poor health, the physically like you and me.

I won't even rule out long distance transportation by continuous-flow for it is entirely possible that long-distance conveyors could be built which would maintain the speed necessary across the open country. Progressive loading and unloading strips would solve the problem of getting to the high-speed belt where you would find little cabs offering seats and protection from the wind and weather.

Truly, the limits of the frontiers of mechanized handling are only those of the imagination. The manufacturers of mechanical handling equipment enjoy an enviable position for they represent the common denominator that runs continuously through all industry and commerce — materials handling. New industries will come and old industries will die, but the designer and builder of handling equipment can be assured that he is here to stay as long as this rather shaky modern civilization can endure; that is, if he continues to develop and fit his design to the ever changing technology of the times.

Materials handling is never an "end" in itself despite the enthusiastic claims of some of its more outspoken proponents. It is even more important; for most "ends" sooner or later die, but our "means" will be adapted to achieve any of an infinite number of "ends" throughout the future.

This position brings with it a great responsibility to study and to evaluate properly all of the implications that are coming in, almost in geometrical progression, as we trend toward automatic living and automatic working. Our design and our application engineering must be tempered with the realization that the most complicated, the most expensive machines that can ever be built will not have the slightest value in themselves. The sole measure of their value is the degree by which they aid man to a better life.

The real wealth of our many-sided industry lies not in its buildings or its machines. There is nothing very special about our plants. Our most valuable assets are the experience and imagination of our people and I'm not so sure but what "imagination" should come first.

● John L. Phillips, Jr. has been named District Manager of Mining Sales, Beckley, W. Va. territory, for the Jeffrey Manufacturing Company, Columbus, Ohio. He succeeds E. H. Hebden who has re-

E. H. HEBDON

turned to Columbus to assume the duties of Manager of Mining Renewal Parts Sales, according to an announcement made by A. R. Anderson, General Manager of Mining Sales.

JOHN R. PHILLIPS

Phillips, formerly Assistant Manager of Mining Apparatus Sales in the Jeffrey home office, has been with the company since 1948. Hebden joined Jeffrey in 1936 after extensive experience in all phases of coal mine operation. He had been Beckley District Manager since 1947.

This Osgood Model '006 Shovel is stripping Redstone seam coal for Mike Kurtak, near Large, Pennsylvania.

Imperial Coal and Construction Company is stripping exceptionally rugged overburden near Duo, West Virginia, to reach seams underneath. Equipment involved includes two Manitowoc Model 3500 shovels and a fleet of dump trucks.

The new Caterpillar D8 pusher tractor bulldozing at the cut in strip coal mine in Canada. The extra power of this latest "Cat" bulldozer was clearly demonstrated on this job.

A view looking down the loading area to the projected stock-pile yard in the distance of the same coal strip mine in Canada.

Caterpillar Diesel No. 6 Shovelg is used for loading trucks with coal at plant in Toronto, Ont., Canada.

Caterpillar Diesel D8 Tractor equipped with No. 8S Bulldozer removes overburden on coal east of Knoxville, Iowa.

● A new heavy-duty, minimum weight rock drill is announced by Davey Compressor Co., Kent, O.

Designed as Model DS-38, it is said to actually be a 4-in-one drill. With the addition of a few accessory parts, it can be quickly converted, without dismantling, from blower type to blast type, or wet type with manual water valve or to wet type with auto-water valve. This makes the tool suitable for almost any drilling condition.

3 rotation speeds — average, fast or slow — can be furnished. Raised center grip and raised tee handles are optional. 5 sizes of collar shank chucks are available. The manufacturer advises that the new drill will, in many cases, outperform heavier tools. This is due to its ease of handling in difficult and confined areas.

An outstanding drill feature is said to be the employment of pneumatic pawls in the rotation ratchet instead of the commonly-used mechanical pawls. These are "pushed" out of engagement with the ratchet teeth at the time the ratchet starts to turn, thus eliminating rubbing wear on the pawls.

Accident Prevention techniques are explained to a group of miners at the Itman operation at Itman, W. Va., of the Pocahontas Fuel Co. The course was conducted by Lloyd G. Fitzgerald (center), mining engineer, and M. J. Hovanec (left), mine inspector, United States Bureau of Mines. Shown here are part of the 70 men who took the course. Left to right are Hovanec, H. M. Runion, Perry H. Harris, Charles Fowler, P. P. Bryant, C. Blankenship, Wiley Bowling, Fitzgerald, Clinton Marsh, Claude R. Hall and A. J. Dempsey.

● Use of JENNITE J-16 to protect and preserve asphalt and black top pavements is recommended by Maintenance Inc., Wooster, Ohio, in a recently published technical bulletin.

Applying J-16 to industrial parking area.

J-16 is applied in a liquid coating over new or old surfaces to form an attractive, waterproof finish. It is said to protect against frost damage, abrasion, oxidation, solvent action of gasoline and oil and the drying effects of the sun. J-16 is recommended for use on driveways, roads parking lots, loading docks and traffic aisles. It is also ideal for gasoline station and garage pavements, airport fueling and parking aprons, runway ends and taxiways. Because it resists heat, it will not run or flow at any temperature. Its surface is easy to clean and free of loose topping.

Easily applied by brush, squeegee or distributor truck, J-16 forms an attractive velvety gray-black coating. It is reputed to at least double the effective service life of asphaltic concrete pavements.

J-16 is available in 5-gallon cans, 30 and 55-gallon drums. For complete data, write Maintenance Inc., Wooster, Ohio. Ask for Bulletin L-352-54.

● Cutting out half the brain of mentally retarded patients caused no loss in intelligence or marked change in personality, Dr. Alexander Tolor and Adam Munz of Columbia-Presbyterian Medical Center, New York, told the meeting of the Eastern Psychological Association here.

In fact, loss of half the brain resulted in a slight gain in I.Q., the scientists found.

The drastic operation was resorted to because the patients—two girls and a boy—had for a long time and uncontrollable seizures and paralysis of one side of the body. They were severely retarded mentally and had behavior difficulties.

The patients, after the operation, did seem to be more aware of being disabled and sick, and they were more depressed.

• Tennessee production of bituminous coal in 1954 ran counter to the national down-trend last year, according to an estimate of the National Coal Association, issued today in advance of official reports by the various states and the U. S. Bureau of Mines. This gain in production was the only one reported among the nation's 28 coal producing states.

Production of soft coal in Tennessee last year rose 12.57 per cent to 6,154,000 tons, from 5,467,000 tons in 1953. This gain for the state compared with the 1954 decline of 14.28 per cent in total national output of bituminous coal, which sagged to 392,000,000 tons —the least for any year since 1939.

Tom Pickett, Executive Vicepresident of NCA, has declared that 1954 production of bituminous coal should "shock even those who are most apathetic about the national security" and warned that the United States is "ill-prepared so long as the coal industry does not have a stockpile of productive capacity to meet estimated demands."

Today's productive capacity of the industry, Pickett said, is "dangerously below" the level needed to guarantee that any future emergency demand of 650,000,000 to 700,000,000 tons can be met.

Import of foreign residual oil and the spreading use of natural gas as a boiler fuel have been the principal causes of declining coal production in recent years and NCA is again in the forefront of a battle to obtain Congressional limitations on importations of foreign residual and of imports of gas from Canada and Mexico.

Some of the expansion in Tennessee production of soft coal last vear was traceable to rising demand for coal to be used in operation of the Tennessee Valley Authority electric plants. Another factor has been rising demand for coal by industrial and other utility plants accompanying a steady climb in non-farm employment within the state. Since 1939, non-farm employment in Tennessee has risen 79.1 per cent, a gain that is more than 25 per cent greater than the rise in non-farm employment in the nation as a whole. The national increase since 1939 has been 63 per cent.

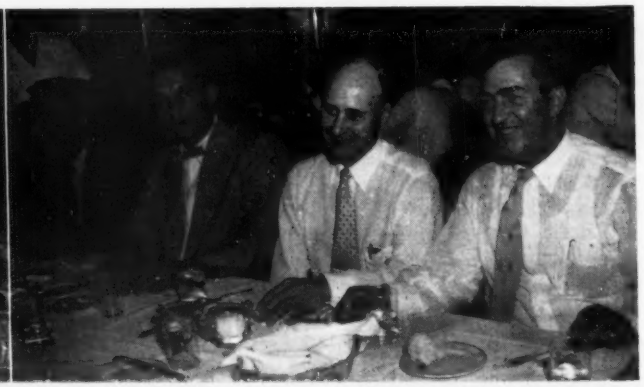
Tennessee's 1954 coal production represented 1.57 per cent of the nation's total output last year and raised to 351,862,000 tons the total production in the state since 1840.

The Lima Paymaster loading out coal.

Stripping With Efficient Small Equipment

• Stripping outcrop coal of the Pittsburgh seam, left in deep mining, near Pleasant Hills, Pennsylvania, suburb of Pittsburgh, Fred Fiori is using a new Manitowoc 3500 to move yellow shale with some rock. Loading is done with a Lima Paymaster shovel into company owned trucks. Output goes to the Industrial market.

The Manitowoc 3500 shovel stripping overburden, assisted by a A-C model HD-20 tractor.



The pictures above and to the right were taken at last years coal men's golf parties in the Pittsburgh area.

Lower left is a picture of the First Aid Team which represented the Hubbard Mine of the Greensburg Connellsville Coal Co. at the Greene County, Pa. Fair. The lower right picture shows the First Aid Team which represented the Westland Mine of the Pittsburgh Coal Co. at the Greene County Fair.

● A new ready-mixed, instantaneous floor patching material that can be subjected to heavy factory traffic immediately after application is announced by The Medal Brick and Tile Co., Wooster, Ohio.

Suitable for use in repairing concrete, brick, mastic or composition floors, the new material is known as Jet-Roc. The manufacturer advises that it contains no asphalts, cements or dehydrators and is chemically inert.

Application consists of simply priming the floor hole, filling with Jet-Roc just as it comes from the package, and tamping or rolling.

Jet-Roc is required to be resistant to oil, gasoline, grease, milk, water, soap and many acids. It is recommended for both indoor and outdoor use.

Other features include resiliency and the absorption of traffic shocks and noises. It is said to be skidproof, easy to clean and non-glaring.

Jet-Roc is available in 5 gal. cans, 30 and 55 gal. drums. For literature and further details, write The Medal Brick and Tile Co., Wooster, Ohio. There are Jet-Roc distributors in most major cities.

● Euclid Division of General Motors Corporation, Cleveland, Ohio is now in limited production on its TC-12 Twin-Power Crawler Tractor.

In the earthmoving equipment industry, the Euclid TC-12 with 40% greater weight, and 80% more H.P. than tractors currently in use, is expected to establish a new size class of crawler tractors. These new "super tractors" will push-load rubber tired scrapers faster, and permit larger scrapers to be utilized. Greater workability of the tractor will be evident in bulldozing, pioneering and towing applications.

The TC-12 incorporates many new operating and maintenance features that are exclusive with Euclid . . . it is the first completely new tractor design in the construction equipment industry for many years. Its outstanding feature is the use of two 194 H.P. Series 6-71 General Motors diesels, each driving one of the tracks through by a single big transverse shaft. Each half is thus free to move 7" up or down to maintain better contact and traction on rough ground. Separate Allison Torquematic Drives consisting of torque converter and semi-automatic transmission. There is no master clutch. Changing from one speed range to another is done under full power. Three speed ranges, forward and reverse, provide speeds to 1.5 mph in low range, 3.0 mph in intermediate, and 8.3 mph in high.

This arrangement of the power train provides simple operation, a smooth steady flow of power and greater drawbar at faster speed. With a separate power train for each track, steering is faster and easier than any previous crawler design. Steering is accomplished by putting either transmission in neutral and using the corresponding steering brake. Tight turns are made by reversing one transmission and keeping the other in forward speed. The operator has "hair trigger" control of steering in any speed range, forward or reverse.

Maintaining proper track tension—a big problem with other crawlers—is automatic on the TC-12. A hydraulic jack maintains uniform pressure on the front idler and an accumulator absorbs recoil if a large stone or other object should get between the track and sprocket.

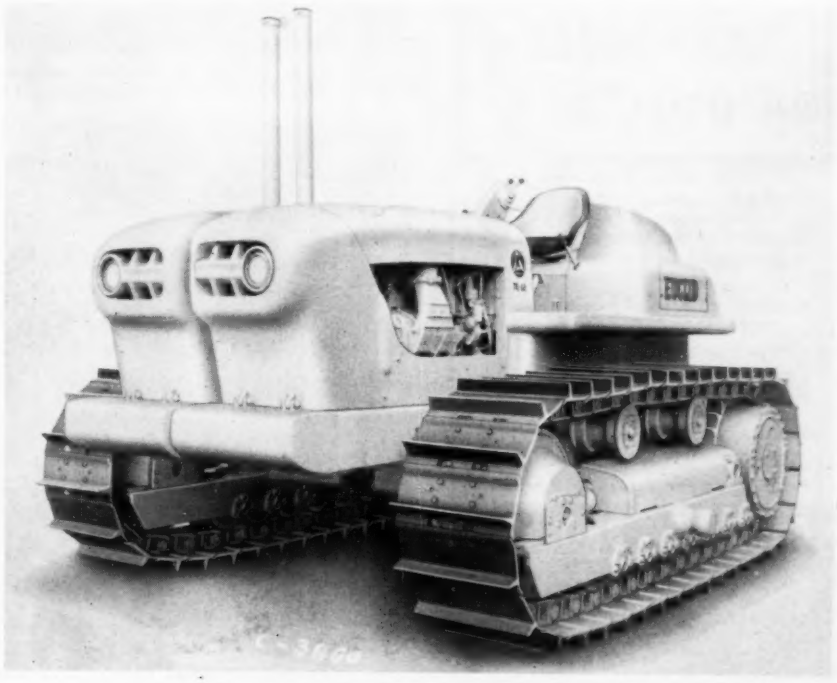
The Twin Power design results in each half of the tractor being a separate unit joined to the other. For shipping purposes, the tractor can be separated into two halves.

Tracv and carrier rollers, 7 on each side, have 1000 hour lubrication. Barrel type bearings have wide spacing and self-adjusting face type seals. Heat treated shaft and rollers are integral units for longer life and lower maintenance. There are 39 shoes on each track—ground contact with 26" track shoes is 6000 square inches.

Another unique design feature is the rear location of the two radiators, each having 28 gallons capacity. There is no obstruction of air flow regardless of attachments—efficient engine operating temperatures can be maintained. Hinged radiator hoods make replacement of a fan belt or other servicing a simple matter.

Final drive is the same planetary design that has been used in other Euclid earthmoving equipment for many years. Planetary gears can be easily serviced without removing track assembly, frame or drive sprocket. No special tools are required for removal of the drive sprocket.

Track gauge is 110", overall width is 136" and overall length is 194". Drawbar height is 23" and ground clearance is 20". Operating weight of the bare tractor is 58,000 lbs. Drawbar pull of the tractor, with normal bulldozer attachments, is 69,750 lbs. dependent on total tractor and equipment weight.



General Motors TC-*2 Twin-Power Crawler Tractor.

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Faster, Safer
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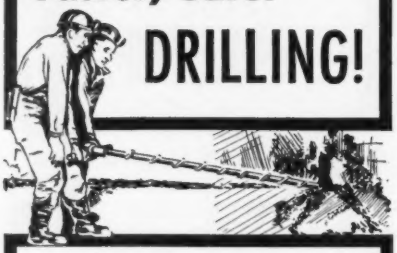

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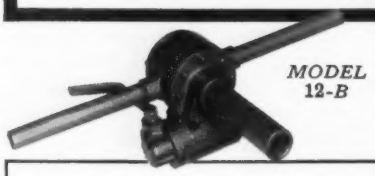

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Safe, dependable, fast drilling with complete safety . . . no spark, no kick . . . all electrical hazards removed yards from drill. Light weight Model 12-B is powered from hydraulic systems of standard mining equipment or can be furnished with Schroeder Tricycle Hydraulic Mobile Power Unit. Features minimum of operating parts and reduced maintenance costs.

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Digging in with steady power, a Michigan Model 75-A tractor shovel loads coal from both stockpiles and tipple of Chutz Brothers, Slippery Rock, Pa.

Caterpillar Diesel D8 Tractor equipped with No. 8U Bulldozer is removing frozen gravel overburden to get to coal seam. Operations near Suntrana, Alaska.

E. N. Turner and Sons use a Manitowoc Model 4500 shovel stripping coal near Harrisville, Pennsylvania. The machine pictured is equipped with a 120′ boom, 5½ Yd. bucket.

● The Galion Allsteel Body Company, Galion, Ohio, announces the appointment of Acme Spring & Equipment Company, Charleston, as distributors of Galion Allsteel products in central West Virginia.

Sales of Galion dump bodies and hydraulic hoists in the Charleston territory will be supervised by S. J. Kish, general manager and R. "Bob" Brown, sales manager. According to O. C. Henkel, Galion president, the new distributor will provide complete maintenance and parts service as well as up-to-date body and hoist mounting facilities.

Acme Spring, located at 626 Maryland Ave., in Charleston, also distributes the Galion line in Columbus and Portsmouth, Ohio. The company carries a complete stock of Galion Allsteel dump bodies, hoists and LOADEVATOR hydraulic end loaders in all three locations.

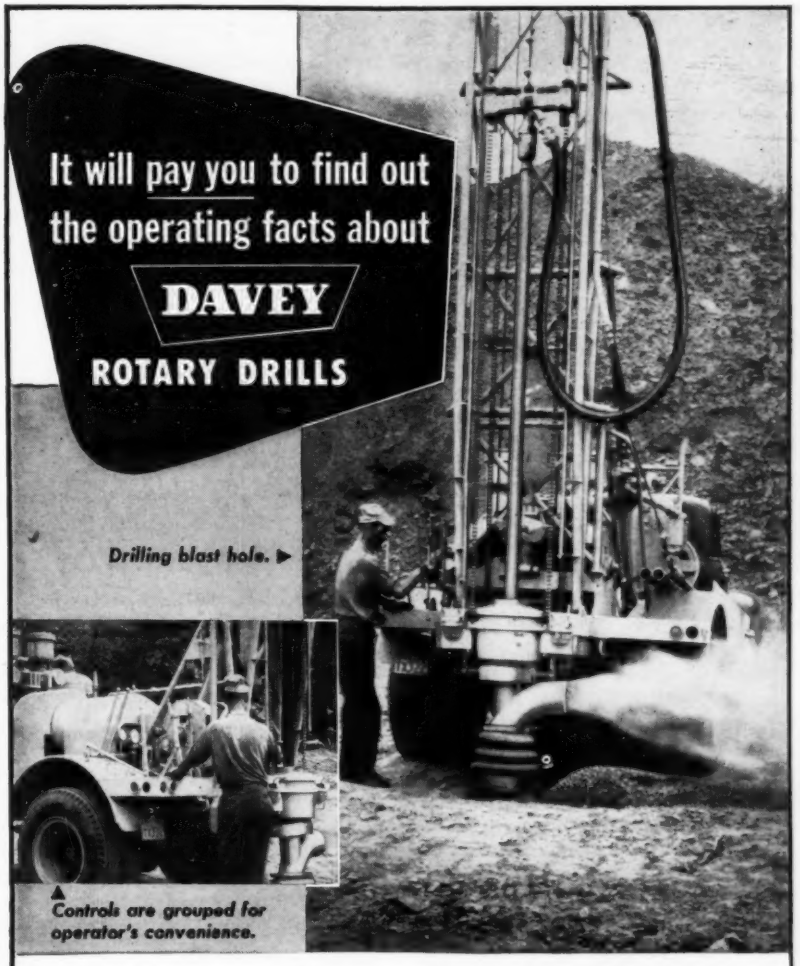
Said to be one of the world's largest manufacturers of dump bodies and hoists, The Galion Allsteel Body Company was founded in 1914. Units of 4 to 45 ton capacity are built in the company's plants in Galion, Mansfield and Cardington, Ohio. Galion Allsteel is an affiliate of Central Ohio Steel Products Co.

● MSA Woodlands Boots, a new kind of footgear for use in the logging industry and other outdoor occupations, have been introduced by Mine Safety Appliances Company of Pittsburgh, Pa.

Designed to protect toes, instep, and sides of the leg from axe and heavy cuts and punctures, MSA Woodlands Boots are waterproof, durable, and flexible from the wearer's comfort and safety.

The newly developed MSA boots allow extraordinary protection due to a specially woven, high-tenacity nylon material used in the construction of side panels and insteps. Other safety features of the new boots include steel toe guards, thick molded rubber soles with deep treads, and steel shanks for preserving the arch of the foot.

Woodlands Boots are fully described in an illustrated bulletin, Number 1302-2, available from Mine Safety Appliances Company, 201 North Braddock Avenue, Pittsburgh 8, Pa.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Controls are grouped for operator's convenience.

for construction jobs... coal work... quarrying

shot holes...blast holes...core drilling...structure testing
water well drilling...oil exploration

Here, at last, is the new line of rotary drills that operators have always wanted and needed.

Available in several "air blast" or "mud pump" models to meet individual requirements, Daveys drill faster and more economically than previously available units. For example, rated capacity of Model M-8A (as illustrated) is 5⅝ inch holes to a depth of 300 ft. with air and 7⅞ inch holes to 2,000 ft. with mud. Suitable for mounting on any make of truck, Davey Rotary Drills may be driven from the truck engine by a power take-off or by a separate gasoline or diesel engine. AA-202

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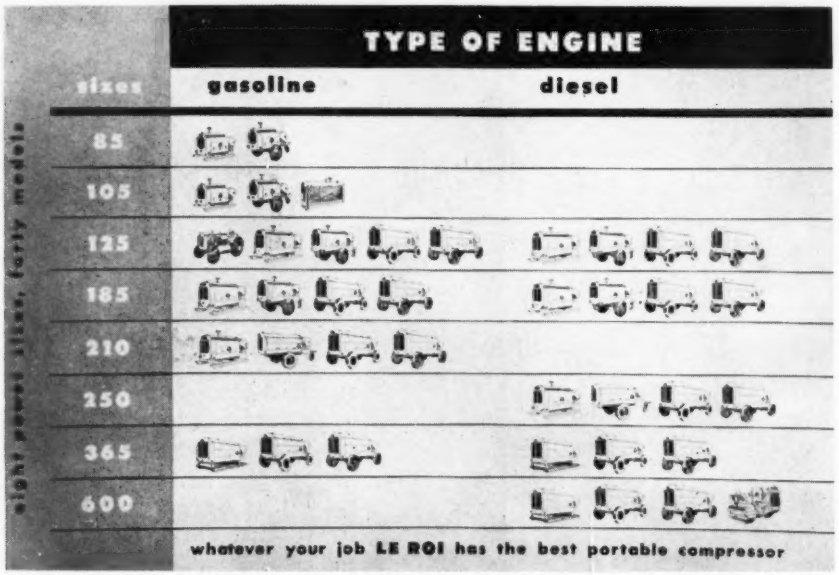


● A new 12-page catalog just issued by Le Roi Division of Westinghouse Air Brake Company pictures all of the 40 models of portable type compressors available. The quick reference chart easily shows the contractor the capacities, engine types, and mountings available.

The colorful bulletin also illustrates the exclusive Airmaster features such as: Replaceable cylinder sleeves, interchangeable valve parts, aircraft type compressor cylinders, heavy duty industrial type engines, and magneto ignition on all gasoline models. Short easy reading captions can provide a quick explanation for the reader in less than two minutes.

Copies of this new piece of literature, CG-9A, can be obtained by writing to: Sales Promotion Department, Le Roi Division, Westinghouse Air Brake Company, 1706 South 68 Street, Milwaukee 14, Wisconsin.

● Publication of a "Drillers Handbook on Rock," reputed to be one of the most comprehensive drilling manuals ever compiled, is announced by Davey Compressor Co., Kent, Ohio.

The 68 page, pocket-size booklet contains a complete description of all common rocks. It discusses their hardness, texture fracture and formation in detail. Readers are instructed how to judge the speeds with which various rocks can be drilled.

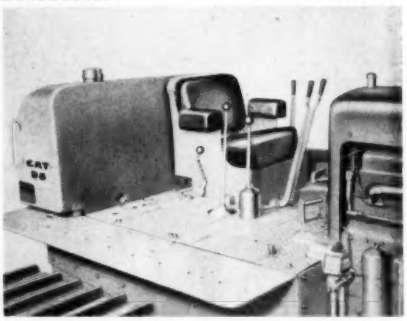
Allis-Chalmers Tractor loader working in coal stockpile in Centre County, Penna.

A method by which the driller can establish a "point system" to figure drillability and drilling cost is also outlined.

The Handbook contains 71 illustrations and 15 charts. Other features are a glossary of approximately 150 commonly used rock and mineral technical names and terms. Modern drilling equipment, ranging from light hand rock drills to large truck-mounted rotary air and mud drills are illustrated and described.

Booklet copies are priced at $1.50 each and may be ordered from the Rock Drill Division, Davey Compressor Co.

A new fan-type, adjustable defroster attachment is now available for all Caterpillar Motor Graders mounted with cabs, according to an announcement from Caterpillar Tractor Co., Peoria, Ill. This new attachment will defrost a much larger area than the element-type defroster.



This view of the new Caterpillar D8 Tractor shows the new design of the operator's position—the easily accessible controls, new smooth deck, higher seat, higher fenders, larger fuel tank which are only a few of the many new features of this recently introduced tractor.

It is made to be installed inside the cab on the right side above the windshield. The unit includes an eight-inch fan blade with a six-volt motor, fan blade guard, mounting bracket, wiring and necessary hardware.

● A 230-drawbar horsepower crawler tractor with turbocharged engine became the sixth machine in Caterpillar's track-type line on May 1. It is the Cat D9 Tractor which already has received considerable attention from construction men, loggers, mining men, and pipeliners during an extensive field testing program in 1954.

Announcement of the 56,000-pound D9—the world's biggest, most powerful production crawler —climaxes 10 years of big tractor

research and development at Caterpiller. Moreover, the Company has drawn upon 50 years of track-type manufacturing experience to produce a "light-footed giant, with every part aimed at the kind of service which is too tough and too rugged for other tractors."

A new 6¼ x 8, six-cylinder Cat Diesel Engine is equipped with a turbocharger, an advancement in track-type tractor manufacture. The tractor also will have Caterpilar's oil-type clutch or optionally a torque converter, in-seat starting, hydraulic track adjustment, excellent operator visibility and many servicing conveniences.

Caterpillar expects the D9 will be used in virtually every track-type tractor application and particularly in general construction, logging, pipelaying, mining and quarrying. Some of the available attachments include the No. 9S and No. 9A Bulldozers, push cup, front and rear cable controls.

Although the tractor is big, general appearance will conform to the other five models of Cat crawlers. Length is 17'10"; width 9'11"; height (excluding exhaust pipe and air cleaner), 8'9". Ground clearance is 21".

Ninety-inch gauge will be standard as will a seven-roller track frame and fixed drawbar. A console-type control panel, seat design and location and careful arrangement of operating controls make a flat, relatively open deck.

There is a six-volt electric starter for the two-cylinder starting engine. The diesel engine, which delivers 286 HP at 1200 RPM for both the torque converter and direct drive models, shows considerable attention to external appearance. Oil lines, fuel lines and water tubes are placed internally as much as possible.

Several features of the engine include (1) short valve push rods which are possible because the camshaft is high in the block, (2) stationary oil jets provide a continuous stream of oil to cool the pistons, the camshaft and followers, (3) steel-backed aluminum bearings with the lower half of the center main bearing to take the camshaft thrust on a flange-type bearing.

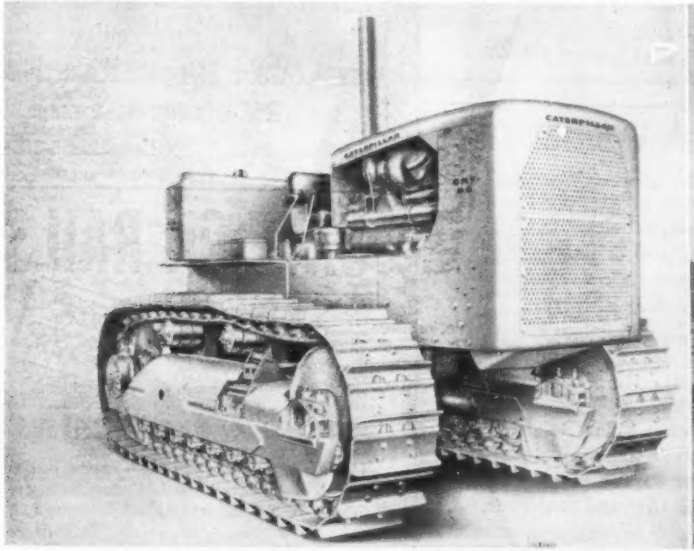
All accessories are driven from a gear at the rear of the crankshaft to avoid much torsional vibration. There is constant power drive for rear-mounted equipment, such as cable controls, providing power regardless of whether the flywheel cutch is engaged or when the torque converter is operating at lowest speeds.

Pressure lubrication and full flow filtration are provided in the engine, the transmission, steering clutch release booster and each final drive. Pressure lubrication is provided also for the oil clutch and starting engine.

The torque converter is a three-stage, 5.1 torque multiplication unit using diesel fuel for the hydraulic fluid. The flywheel clutch used with the torque converter is a 19-inch singe plate, dry-type. Torque converter fluid cooling is provided by a water-type heat exchanger mounted on the right hand side of the engine. Speeds up to 7.8 MPH with three speeds forward and two in reverse are provided. The direct drive has six speeds forward and six in reverse ranging from 1.6 to 6.8 MPH. With the direct drive transmission, drawbar pounds pull of 60,860 pounds are possible with adequate weight and traction.

Welded fabrication of the steering clutch case and main frame provides a rugged backbone for the entire tractor assembly which fits in with the severe service to which this machine will be subjected. A one-piece welded track roller frame includes closed oil-type recoil spring housing and track guiding guards at each end of the frame. The equalizer bar rests on moulded rubber pads on the track roller frame. Heavy-duty radiator guard and half-inch thick fenders are standard equipment.

The conventional drive D9 will weight 53,200 pounds and the torque converter model, 56,650 pounds. The seven-roller track frame insures great flotation and stability. The front idler is the



The Cat D9 Tractor, sixth machine in Caterpillar crawler line, is a 230-drawbar horsepower turbocharged tractor resulting from 10 years of big tractor research and development. Thoroughly field tested during 1954, when Caterpillar put ten D9Xs on various jobs from coast to coast, it is expected that the 56,000-pound machine will have many earthmoving and construction applications.

One of the first D9Xs to leave Peoria was sent to the Marquette Cement Co. at Oglesby, Ill., where it operated both as a pusher and self-loading a No. 90 Scraper stripping overburden. Later this same machine was sent to California where it pulled a ripper on the Guy Atkinson Co. job on Cherry Valley Dam. The owner-operated, Company-maintained D9Xs worked thousands of hours in all types of conditions.

fabricated disc type. It is a two-position idler and may be adjusted for either dozer or drawbar work.

The standard track shoe, heat treated for wear resistence and strength, is 24 inches wide and there are 43 shoes to each track. There will be 129 ¾ inches of track on the ground making a total ground contact of 6,228 square inches. Weight per drawbar horsepower is 235 pounds. Twenty-seven and 30-inch shoes are available as optional equipment.

Many features of the D9 were designed with operator comfort in mind. Starting engine controls are readily accessible from the seat. The one-man seat has sponge rubber cushions and is adjustable fore, aft, and vertical. Oil clutch, steering clutches and brakes are power assisted for ease of operation.

Safety was considered throughout. There are locks on both brake pedals. Pumps are mounted on the rear of the engine to provide constant power for hydraulic actuation of brake and clutch boosters. Grab irons are mounted on the rear and sides of the fuel tank for boarding the tractor and another is on the left radiator guard for servicing the air cleaner.

The deck has been cleared of all but the most essential controls and those are placed for maximum efficiency. The bulldozer cable tube for the rear cable control unit is incorporated in the right hand main frame member for safety and appearance.

Many service conveniences have been built into the D9. The hydraulic track adjuster requires only a grease gun to operate. The steering clutch and brake drum assemblies can be removed separately without disturbing the bevel gear. The flywheel clutch assembly or the torque converter unit can be removed without disturbing the engine or the transmission.

The transmission barrel assembly can be removed without disturbing the flywheel clutch. Brakes and steering clutches can be adjusted through easily removed top covers in the steering clutch housing. Brakeband assemblies can be replaced without removing the fuel tank assembly. Removal of the engine from the tractor can be accomplished without disconnecting the gauge lines and starting engine controls, since the gauge panel is mounted on the engine.

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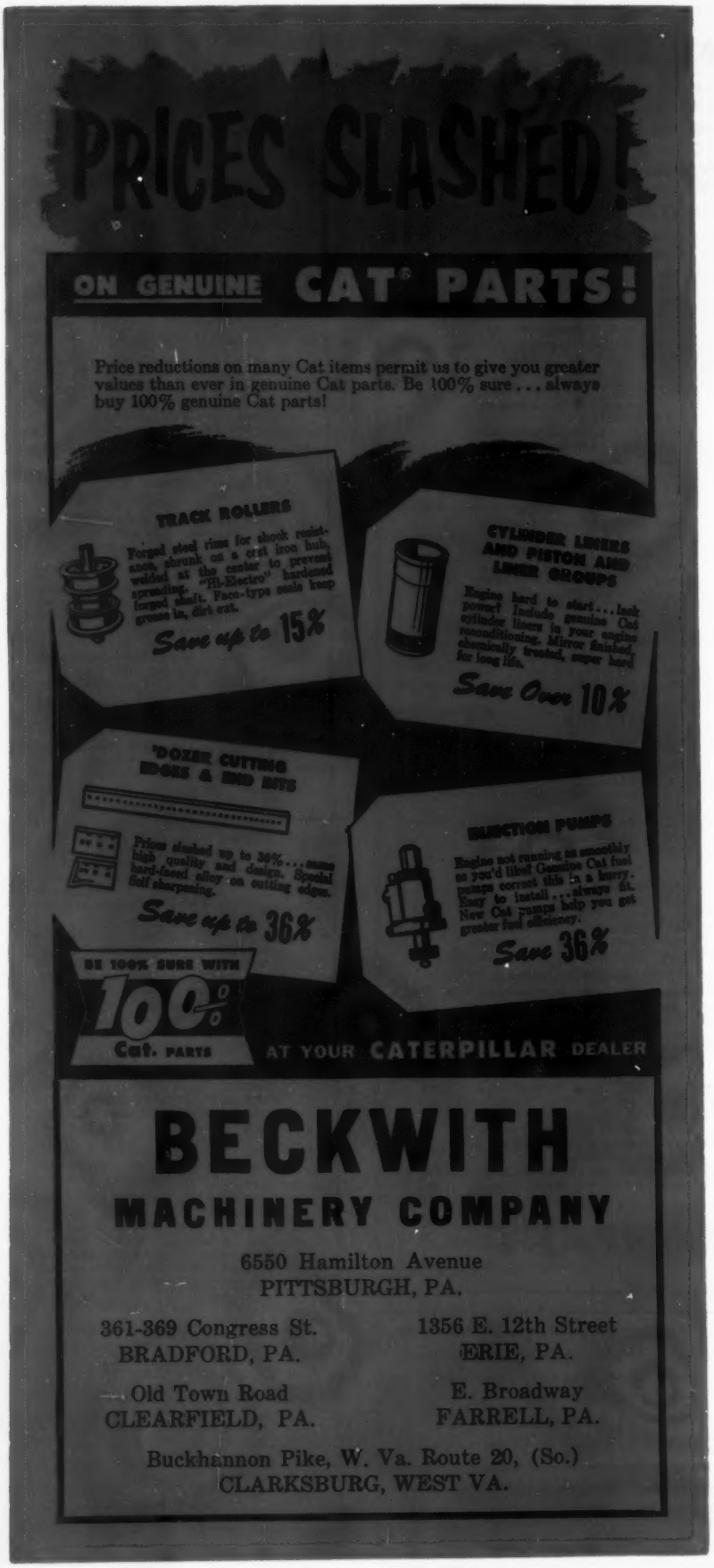
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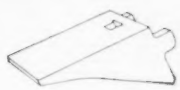

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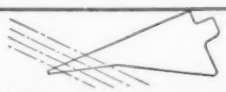

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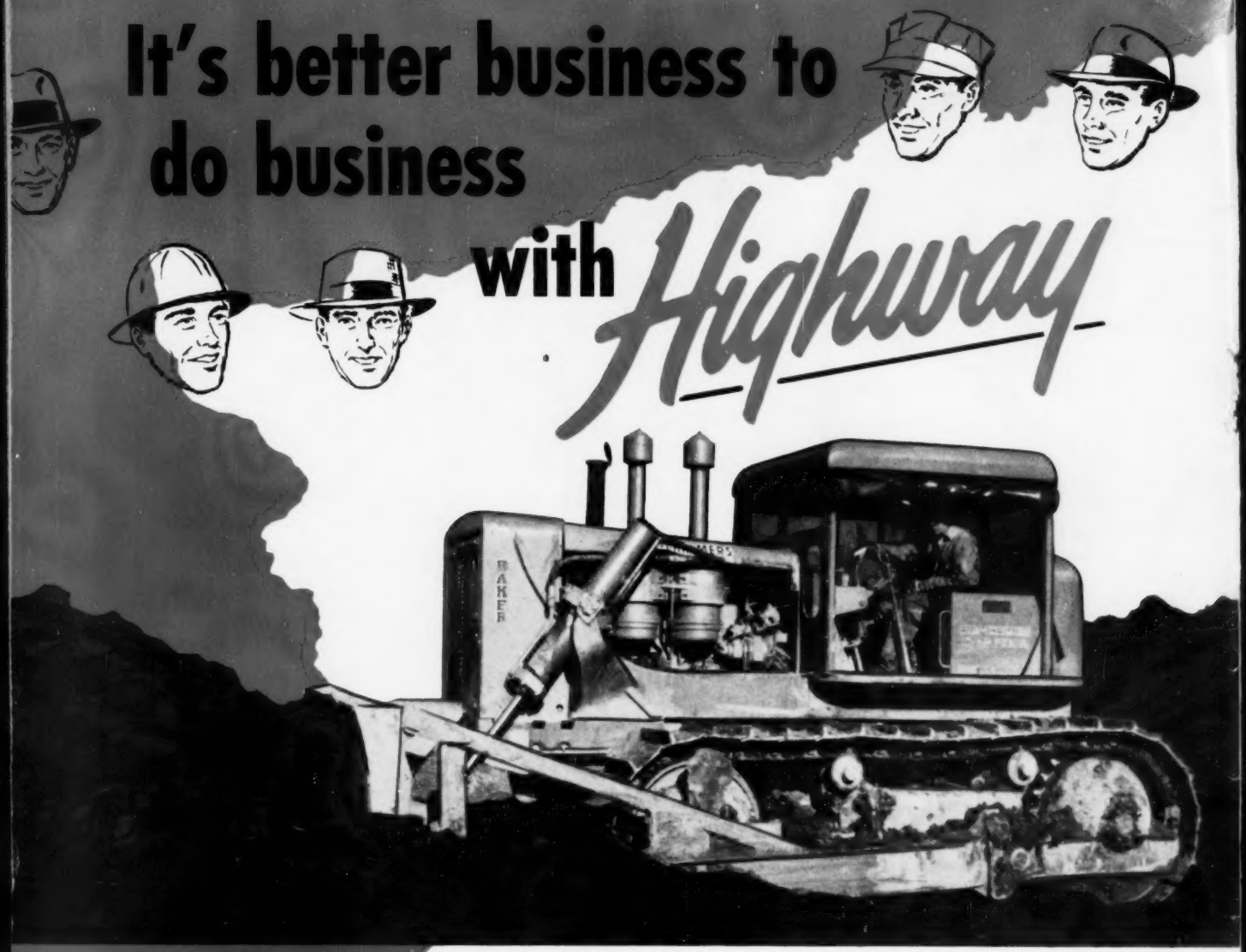

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